Moneda y Crédito

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220

[2005]

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INTRODUCCIÓN Y RESUMEN

En 2004 la Unión Europea amplió su ámbito geográfico al aceptar diez nuevos países. Los países entrantes tienen en general características económicas y sociales muy diferentes de las de los quince países que hasta entonces formaban la UE; en particular el nivel de renta per cápita de los entrantes es mucho más bajo y presentan además desequilibrios estructurales más acusados. El presente volumen de Moneda y Crédito recoge las ponencias presentadas en el XVII Simposio, que tuvo lugar los días 18 y 19 de noviembre de 2004 bajo el título *"El Futuro de la Unión Europea Ampliada"*, organizado por la revista con el propósito de estudiar las implicaciones del proceso de ampliación.

En el primer artículo, *"European Macroeconomic Challenges and EU Enlargement"* Susan Schadler (European Department, International Monetary Fund) argumenta que, con el fin de acelerar el proceso de convergencia, es preciso poner el acento en tres aspectos: intensificar el uso de capital en las empresas para aumentar la productividad del trabajo y los salarios, acelerar la incorporación de nuevas tecnologías y aumentar la participación laboral reduciendo las tasas de desempleo. Las fuerzas de mercado facilitarán este proceso ya que la moderación actual de los salarios incentivará la afluencia de capital exterior y la apertura comercial facilitará la transferencia de tecnología. Entre las políticas macroeconómicas que pueden contri-

buir a acelerar este proceso de convergencia, la autora destaca la conveniencia de una rápida transición al Euro, con la adopción de las consiguientes políticas de estabilidad.

El segundo artículo lleva por título *"Inflation Differentials in EMU: the Spanish case"* y en él sus autores, David López-Salido (Banco de España), Fernando Restoy (Banco de España) y Javier Vallés (Banco de España), estudian los determinantes de los persistentes diferenciales de inflación de España con respecto al resto de la UEM en el marco de un modelo de equilibrio general dinámico. Entre estos determinantes destacan la pujante de demanda doméstica de bienes no comerciables y las rigideces salariales, mecanismos cuya potencia es tal que prevalece sobre el efecto contrario que supone la progresiva pérdida de competitividad que la inflación está generando en nuestra economía. Por ello, en ausencia de medidas de política económica adecuadas, la pérdida de competitividad de la economía española puede convertirse en un fenómeno muy duradero.

El trabajo se completa con la discusión de György Szapáry (Magyar Nemzeti Bank, the Central Bank of Hungary).

Daniel Pérez (Banco de España), Vicente Salas Fumás (Universidad de Zaragoza y Banco de España) y Jesús Saurina (Banco de España) son los autores del tercer trabajo del volumen: *"Banking Integration in Europe"*. El trabajo estudia la influencia del Euro en la evolución el proceso de integración bancaria en Europa, mediante la explotación de un novedoso conjunto de información. La evidencia empírica muestra que este proceso se ha visto acelerado por la introducción de la moneda única ya que progresa más rápidamente en la UEM que en otras regiones del mundo desarrollado. Sin embargo la integración de la industria bancaria dista mucho de ser un proceso homogéneo por países ya que, además de las fuerzas de mercado, sobre la integración bancaria influyen notablemente el conjunto de regulaciones legales e institucionales que son aún muy diversas entre los países del área Euro.

Stephen Cecchetti (Brandeis University) y Guillermo de la Dehesa (CEPR) aportan sus comentarios y sugerencias a las cuestiones plateadas en el trabajo.

En el cuarto artículo, *"Exchange rate regimes for the New Member States of the European Union",* José García Solanes (Universidad de Murcia y CentrA) y Ramón María-Dolores Pedrero (Universidad de Murcia) derivan los regímenes cambiarios óptimos para ocho de los nuevos estados miembros de la UE en el curso de sus primeras etapas

hacia la UEM. Los cálculos empíricos se basan en un modelo teórico en el que los agentes son racionales y que incorpora un índice representativo de las distorsiones de mercado internas y de los desfases tecnológicos relativos de cada país. El principal resultado es que el régimen cambiario que maximiza el bienestar varía según los rasgos estructurales de cada economía y en función de la naturaleza de las perturbaciones a las que está expuesta cada una de ellas.

Enrique Alberola (Banco de España) y Simón Sosvilla (Universidad Complutense, FEDEA) analizan la contribución del trabajo, aportando sugerencias para estudios posteriores.

Filippo Altissimo (European Central Bank), Pierpaolo Benigno (New York University) y Diego Rodríguez Palenzuela (European Central Bank) son los autores del quinto artículo *"Long-run Determinants of Inflation Differentials in a Monetary Union"*. En el trabajo se analizan los diferenciales de inflación en una unión monetaria que, en el caso de la UEM, se manifiestan principalmente en los precios de los servicios. El marco analítico difiere en varios aspectos de la hipótesis Balassa-Samuelson y los autores concluyen que los principales causantes de los diferenciales son las variaciones relativas de productividad en el sector de bienes no comerciables, mientras que los shocks de productividad en el sector de comerciables son absorbidos por movimientos en la relación real de intercambio.

Los comentaristas de este trabajo son Philip Lane (Trinity College) y Kosuke Aoki (London School of Economics).

El volumen concluye con el artículo *"Political Decision Making in the Enlarged EU"* de Richard Baldwin (Graduate Institute of International Studies y CEPR) y Mika Widgren (Turku School of Economcis y CEPR). Los autores analizan las variaciones en las reglas de decisión en la Unión Europea y concluyen que aunque las nuevas reglas del Tratado Constitucional que sustituyen a las acordadas en el Tratado de Niza son más operativas, su efecto tardará en notarse ya que no entrarán en vigor hasta que el proceso de transición este culminado. Esto es preocupante ya que durante este periodo se tomarán importantes decisiones sobre la política agrícola y sobre fondos estructurales. Por ello, los autores afirman que la corrección en la práctica de los errores cometidos en el diseño del sistema de votación en el tratado de Niza ha de ser un objetivo fundamental de los dirigentes de la UE durante los próximos años hasta que la Constitución Europea entre, eventualmente, en vigor.

European Macroeconomic Challenges and EU Enlargement

Susan Schadler[1]

Deputy Director, European Department International Monetary Fund

The European Union (EU) took a bold step in May, 2004 accepting 10 new members with substantially different economic histories and characteristics than the 15 existing, and rather homogeneous, incumbents. The new member states (NMS)—which will comprise 17 percent of the enlarged Union's 460 million population—bring to the Union substantially lower per capita income levels with all the accompanying differences in structural and technological characteristics; with significantly lower employment rates; and with considerably larger macroeconomic imbalances. Is this an extra burden on a union that is already struggling with its own structural and macroeconomic problems? Perhaps, but at least as importantly it will be a potential source of dynamism, as the new members seek to realize their full productive potential, particularly the eight emerging from a half century of mismanagement under socialist regimes. On balance, whether this bold course turns out to be a burden or boon over the next decade or even beyond will depend at least in part on macroeconomic policy decisions of both old and new members.

Perhaps the central economic challenge in enlargement is to increase living standards in the new member states to those in the EU-15

1. The paper draws heavily on "Adopting the Euro in Central Europe—Challenges of the Next Step in European Integration" by Susan Schadler, Paulo Drummond, Louis Kuijs, Zuzana Murgasova, and Rachel van Elkan, forthcoming IMF Occasional Paper, 2004.

as expeditiously as possible. Obviously in the interests of the NMSs, this will also redound to the benefit of the old members by expanding export markets, minimizing requirements for supporting development in the NMSs, and generally enhancing the wealth of the Union. The aim therefore must be to achieve the income catch-up as quickly as possible, in a way that enhances political harmony both between and within countries and that does not precipitate bouts of economic instability. In the starkest terms possible, the catch-up will require three broad processes: raising the comparatively low capital-labor ratios in the NMSs so as to increase labor productivity and wages; boosting total factor productivity by technological improvements; and increasing generally low labor force participation rates and in some countries reducing high unemployment rates. Market forces should support these changes: low wages in the NMSs will attract capital; increased openness to trade and capital flows will facilitate technology transfer; and stronger economic activity will increase demand for labor and, provided incentive systems are not impediments, labor supply will respond. At the same time, the large wage differential between the NMSs and the old-EU will attract workers to the west, although during the 7-year transition to greater labor mobility, this is not likely to be a major equilibrating influence.

Among the many macroeconomic policies that will bear on these aspects of enlargement, a powerful instrument in the EU tool box is euro adoption. Of course all NMSs are committed to adopting the euro eventually, but the timing and conditions under which it is accomplished could be important influences on the pace of the income catch-up. I will argue in this paper that with macroeconomic policies geared toward the requirements of participation in the common currency, early euro adoption would make a strong and effective contribution to the income catch-up. This argument essentially revolves around the view that the benefits for trade of being part of the euro area, together with the discipline of the euro area macroeconomic policy framework, would outweigh any costs from foregoing an independent monetary policy. A critical consideration in this balance, however, is whether countries (particularly those that now have flexible exchange rates) can steer clear of financial market vulnerabilities without monetary policy independence during ERM2 and the early years of participation in the euro area.

The paper is organized in four sections. Section I briefly presents salient characteristics of the NMSs to highlight the scope and nature of the challenge in catching-up. Section II reviews recent evidence on

the costs and benefits of early euro adoption. Section III examines potential vulnerabilities in the process. Section IV provides conclusions.

I . THE NEW MEMBER STATES—A SNAPSHOT

The legacy of central planning has left marked differences between basic structural characteristics of the CECs and those of other EU members. And while accession to the EU and the requirements of the Acquis Communataire will result in a marked convergence of the NMSs' legal, administrative and infrastructural attributes, the more enduring structural differences will set the basic parameters for the process of income convergence. In the starkest terms, five key structural characteristics of the CECs define the requirements for income convergence.

1. The income gap vis-à-vis the euro area is large and shrinking relatively slowly.

Per capital GDP at PPP exchange rates in the CECs ranges from 40 percent of the euro area level in Poland to over 70 percent in Slovenia (Figure 1). PPP GDP per capita in each country except Slovenia is below the poorest of the EU-15. Convergence over the past 10 years has been modest, compared to that of the lowest income EU-15 countries: annual growth of per capita GDP in the CECs has exceeded average EU-15 growth by between 0.3 percentage points (Czech Republic) and 3 $^1/_2$ percentage points (Estonia and Latvia), compared to a range of 0.3 (Portugal) - 4 $^1/_2$ (Ireland) percentage points for the four lowest income EU-15 countries.

2. The CECs are capital poor and labor rich compared to advanced EU countries.

Average capital-labor ratios in the CECs are substantially below those in the advanced EU countries (Table 1). The scarcity of physical capital, together with reasonably strong endowments of human capital, suggests that that marginal product of capital is relatively high in the CECs. Provided the large differences in output per worker reflect dif-

Figure 1.
CEC8 + EU4: PPP GDP per Capita Relative to EU-15
(In percent)

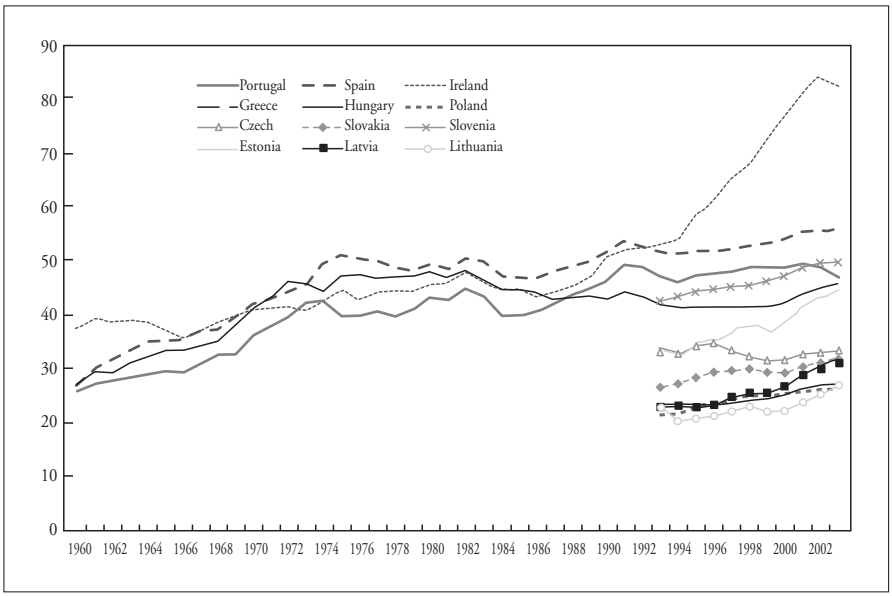


Table 1:
CECs: Productivity of Capital, 2002

	GDP per Worker 1/	Capital per Worker 2/ 3/	MPK 3/4/
Czech Republik.	57	33	1.7
Estonia	48	24	2
Hungary	65	34	1.9
Latvia	38	8	4.8
Lithuania	44	4	10.6
Poland	50	20	1.7
Slovak Republik	56	22	2.6
Slovenia	84	140	0,6

Sources: Lipschitz, Lane and Moumouras (2004); Eurostat and Poland (Central Statistical Office) labor force data.

1/ As a ratio to German GDP per worker.

2/ As a ratio to German capital per worker.

3/ Assumes total factor productivity (TFP) in each country is 70 percent of that in Germany see Lipschitz, Lane and moumouras, 2004.

4/ Marginal product of capital (multiple of German estimate).

ferences in capital-labor ratios rather that inherently low total factor productivity owing to institutional or technology differentials, the profitability of investment in the CECs should be substantially higher than in advanced EU countries.

3. Even with low capital-labor ratios, employment ratios in the CECs are among the lowest in Europe.

On average employment rates are about 90 percent of the average rate in the EU-15, owing to relatively low labor force participation and in some countries high unemployment (Figure 2). Employing more of the working age population, however, may be a slow process because of the apparent structural nature of the unemployment problem in the CECs: whereas 57 percent of unemployed workers in the EU has been without a job for more than 6 months, 70 to 85 percent of the unemployed in the CECs have been without a job for more than 6 months. In some cases, labor market rigidities—reflected in the intensity of employment protection—also are an impediment.

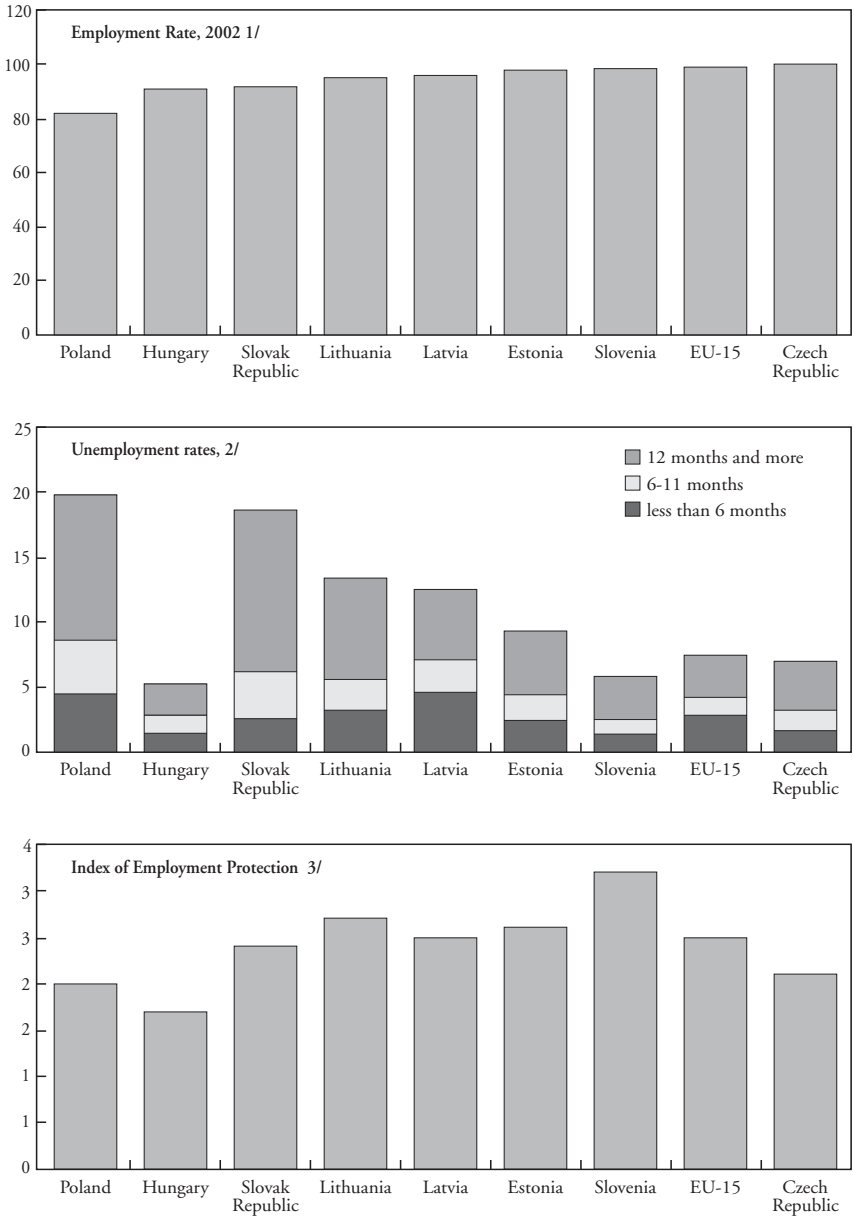
4. These conditions are unleashing high investment rates. In each CEC, total investment relative to GDP substantially exceeds the EU-15 average (Figure 3).

This is financed both by higher domestic savings rates and larger use of foreign savings (current account deficits) than in the EU-15. Similar differences are seen for private investment and savings.

5. Financial sectors for intermediating savings are small but, with a heavy presence of foreign institutions and reasonably good supervision, are poised for expansion.

By any measure of money aggregate, CEC financial sectors are small (Figure 4) but growing rapidly. Banks –and in all countries except Slovenia foreign-owned banks –dominate the provision of financial services. Bond market capitalization—primarily government bonds—is about 30 percent of GDP on average, compared to 130

Figure 2.
CECs: Employment Conditions



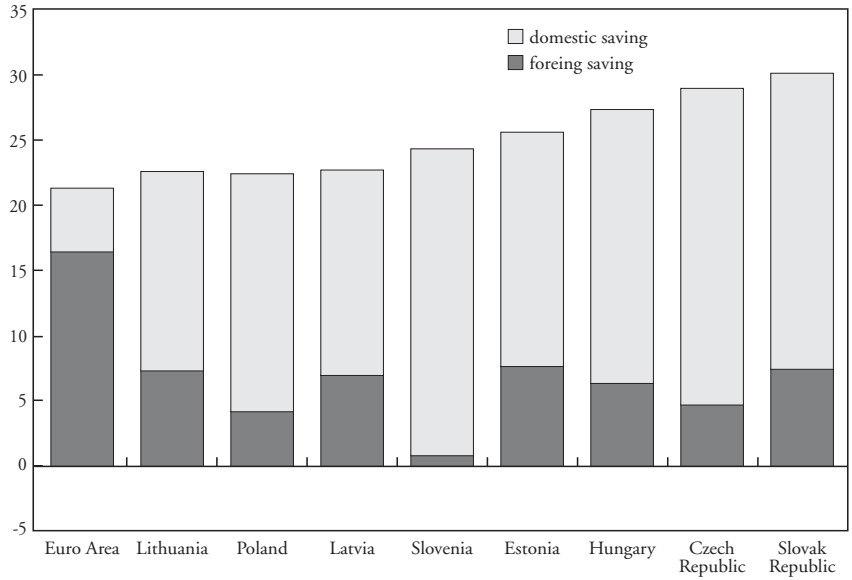
Source: Eurostat; OECD.

1/ Total employed persons/working age population; ratio of CECs to euro-area average, 2002 data.

2/ Unemployment rate for 2002.

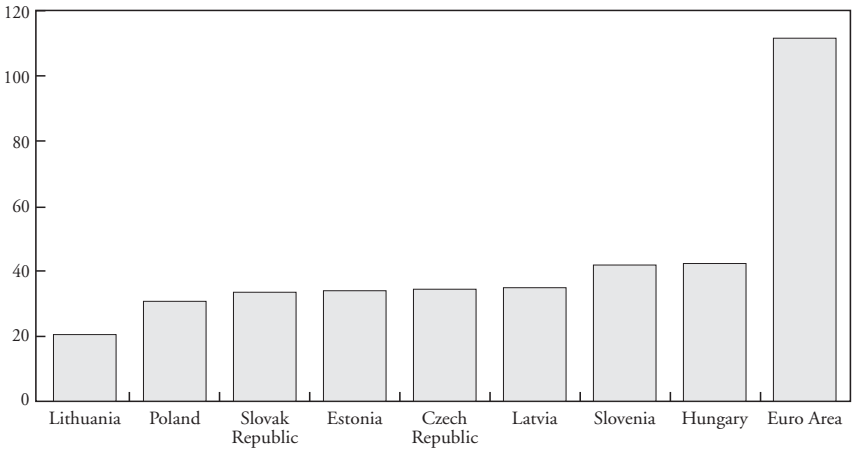
3/ Overall EPL rigour from OECD (1999); with a higher number indicating stricter employment protection.

Figure 3.
CECs and Euro Area: Investment, 1996-2002
(In percent of GDP)



Source: IMF, World Economic Outlook.

Figure 4.
CECs and Euro Area: Bank Credit to Private Sector, end-2003
(In percent of GDP)



Source: IMF, *International Financial Statistics.*

percent in the euro area. Equity markets are still small. Bond and equity derivatives account for only 1-2 percent on market capitalization of the underlying assets, in contrast to some Asian countries where derivatives are a multiple of the market capitalization. FSAPs in each of the CECs found that regulatory and supervisory systems are moving toward international best practices.

Against these structural differences between the CECs and the EU-15, key macroeconomic conditions tend to be more converged. Nevertheless, differences in economic structure will continue to be reflected in differences in some aspects of macroeconomic conditions—particularly current account deficits and, to a far lesser extent, inflation. Understanding which of these differences are equilibrating and which are disequilibrating will be key to containing the inherent risks to macroeconomic stability during the catch-up.

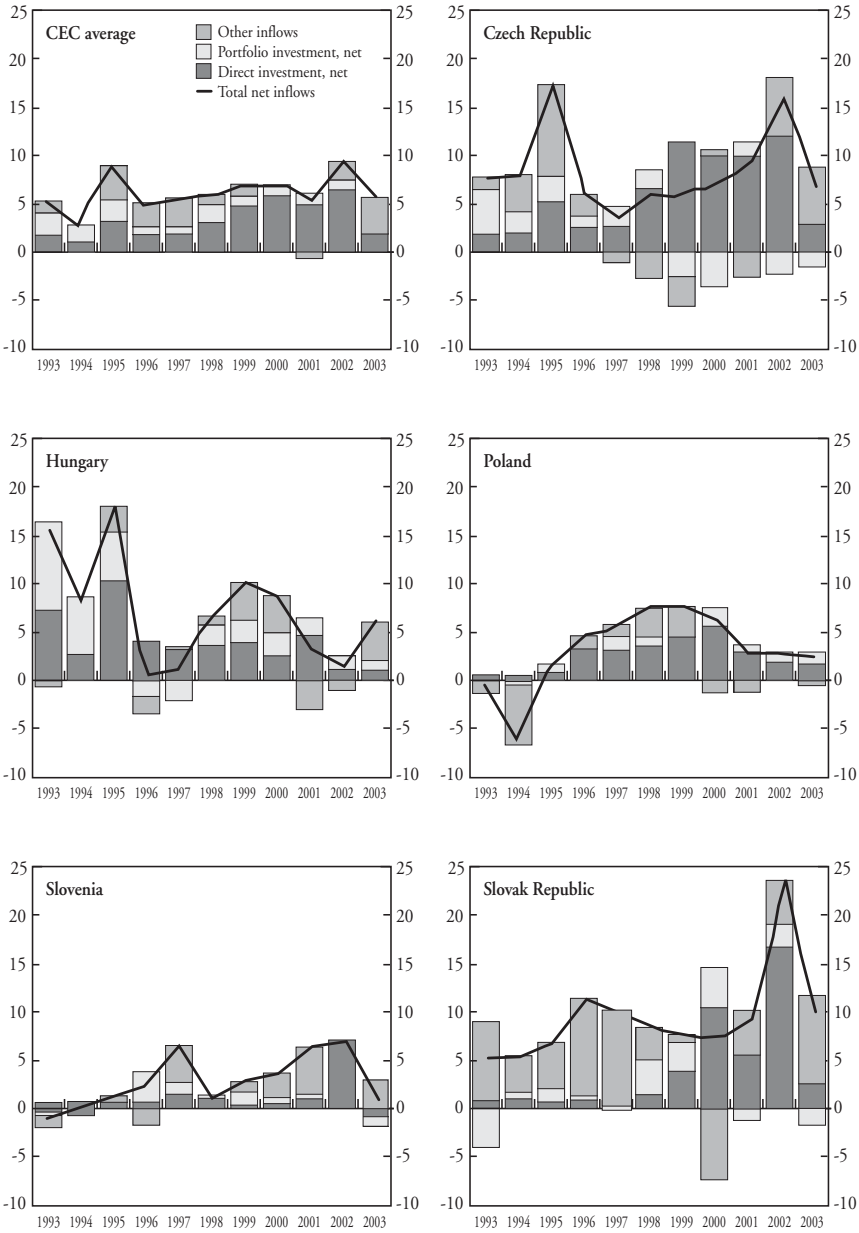
1. *Reflecting the absence of capital controls and large use of foreign savings, capital inflows are large and prone to volatility.*

   On average, the CECs had net capital inflows (including errors and omissions) equivalent to over 7 percent of GDP during 2000-03 (Figure 5). Although the composition of inflows varied widely across countries, for most CECs FDI accounted for at least 75 percent of the total, except in Slovenia (40 percent). While large inflows are expected in light of high estimated returns on capital, inflows were volatile. Over the past decade, the standard deviation of annual net inflows ranged from 59 percent of the average level in Poland to 84 percent in Slovenia. The great majority of controls on capital flows have been eliminated to conform to commitments to the OECD and the EU.

2. *Sizable real appreciations of domestic currencies have reflected partly, but not fully, tradable-nontradable productivity growth differentials (Figure 6).*

   Balassa-Samuelson (B-S) effects—faster productivity growth in the tradables than in the nontradables sector that forces nontradable prices to rise faster than tradable prices—appear to have induced increases in the domestic price of nontradables relative to tradables in the CECs by an average of about 3 percent per year: variation across countries, however, has been considerable (Begg and others, 2002, and Cipriani, 2000). But the contribution of B-S effects to real (CPI-based) appreciation, which must also account for the size of relative

Figure 5.
CECs: Net Capital Inflows, 1993-2003 1/
(In percent of GDP)

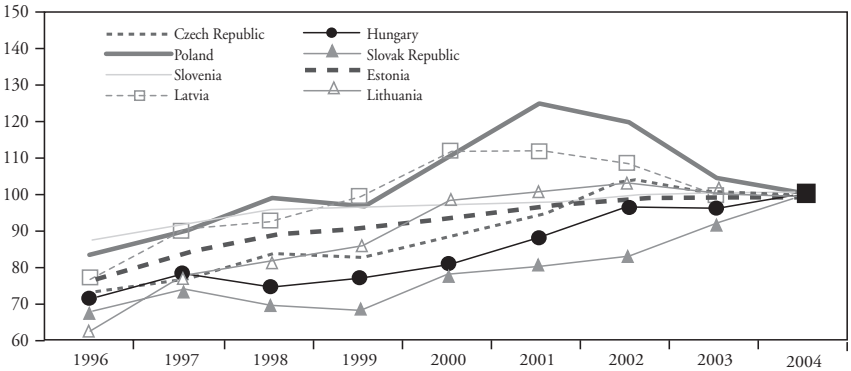


Source: IMF, *World Economic Outlook*; and Slovenian authorities.

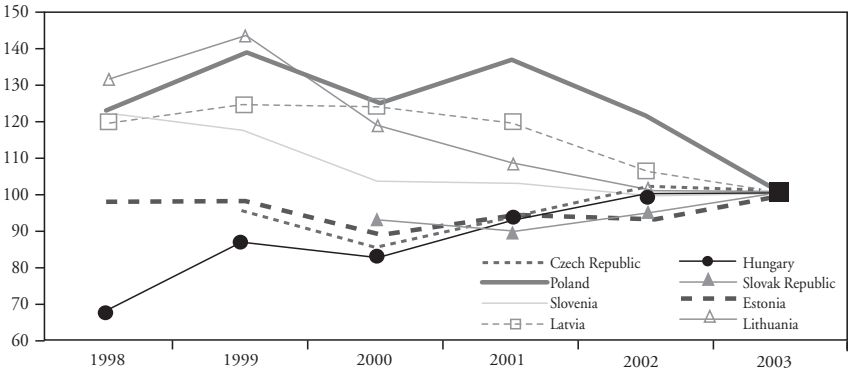
1/ Data for 2003 are IMF Staff estimates.

Figure 6.
CECs: Real exchange Measures
(Period average, 1996-2004) 1/

CPI-based Real Exchange Rates against Germany,
(Period average, 2004=100) 1/



Unit Labor Cost Relative to Germany,
(Period average, 2003=100) 2/



Source: IMF, International Financial Statistic; Country authorities; and IMF staff calculations.
1/ For 2004 average January-September.
2/ Based on value added in manufacturing except for Poland, Estonia and Latvia (wich is based on value added in industry).

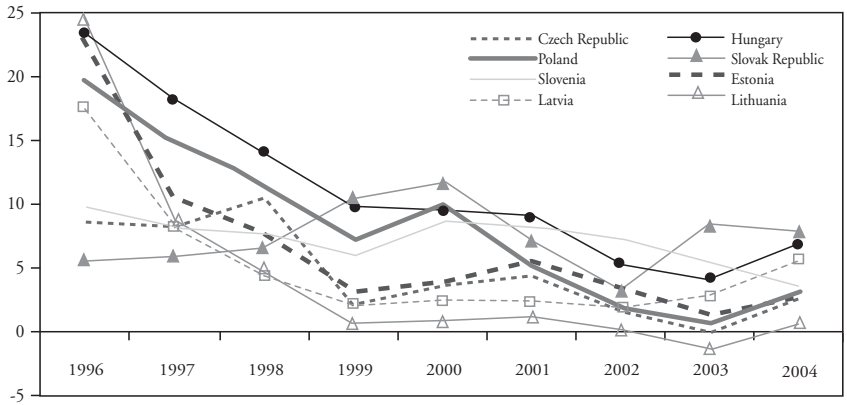
price changes in comparator countries, is estimated at only about 1-2 percent per year relative to Germany (Kovacs and others, 2002). Since actual real (CPI-based) appreciations since 1996 have generally exceeded the estimated contribution of B-S effects, either other influences have been at play or some overshooting of equilibria has occurred. Other possible influences include catch-up from previous undervaluation, deregulation and price liberalization of non-tradables, increases in indirect taxes, and demand-induced increases in nontradables prices owing to growing real incomes. Far smaller

appreciations of ULC-based effective exchange rates is somewhat reassuring that overvaluation is not the major explanation.

3. *Notwithstanding B-S effects, inflation has fallen.*
   In some of the CECs, the drop has been to low levels even by euro-area standards (Figure 7). In the lowest inflation countries—Lithuania, Czech Republic, Estonia and Poland—conjunctural developments and/or recent nominal appreciations contributed. In other countries, somewhat higher inflation reflects a variety of influences: larger increases in unit labor cost (Hungary and Slovenia); nominal depreciations (Slovenia) or muted nominal appreciations (Hungary and Slovak Republic); and recent indirect tax and administered price changes (Slovak Republic).

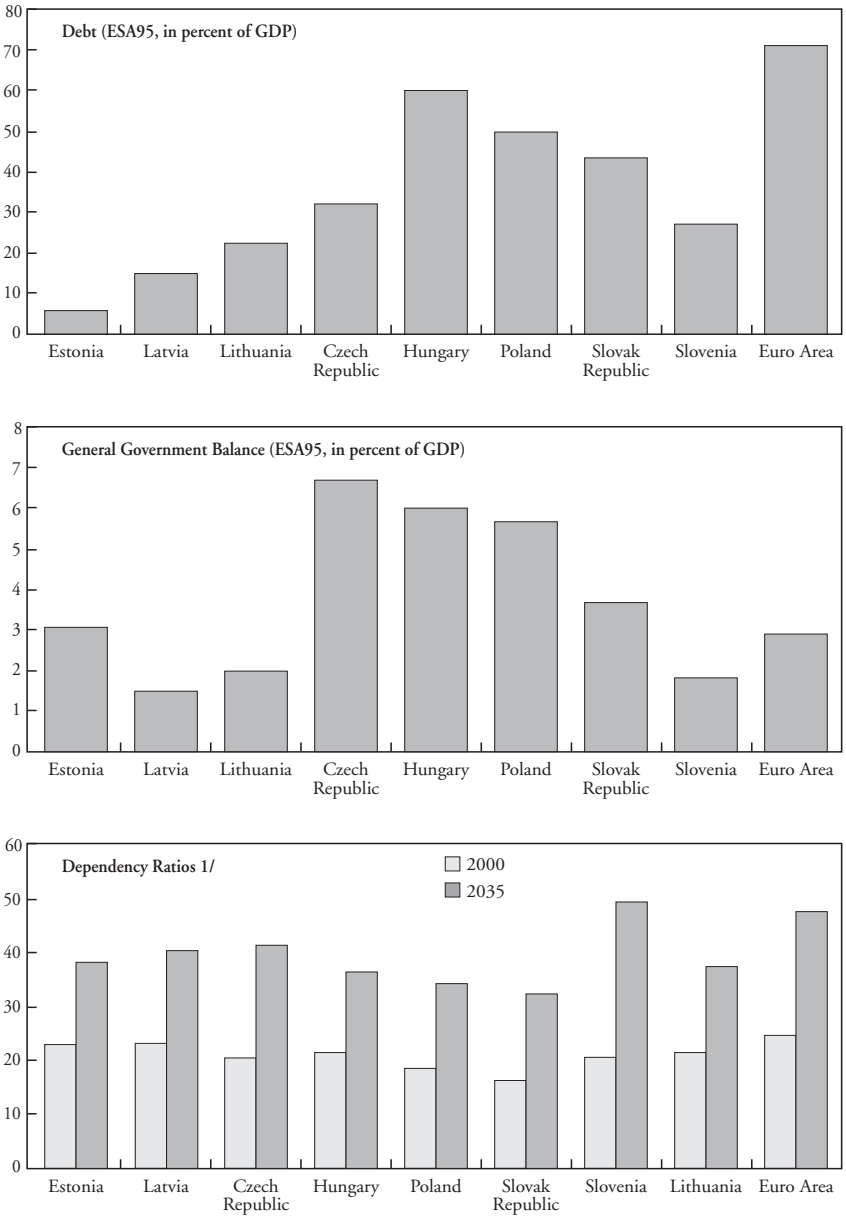
4. *Fiscal deficits of some CECs are large, but debt is moderate and future demographics are not as threatening as in the EU-15.*
   In 2003, deficits were well below the EU-15 average in the Baltics and Slovenia, but well above that average in the other four CECs (Figure 8). Government debt ratios in all were below 60 percent of GDP. In general, the root of the divide between high and low deficit countries was the size of structural expenditures—particularly in the social sphere. Output gaps—estimated to be negative in all the higher deficit countries—also played a role. Although aging pressure on

Figure 7.
CECs: Consumer Price Index, 1996-2004 1/
(Percent change, period average)



Source: IMF, *International Financial Statistics*; and IMF staff estimates.
1/ For 2004 average January-September.

Figure 8.
CECs and Euro Area: Fiscal Posiutions and Pressures



Source: UN, World Population Prospects: The 2002 Revision; National authorities and IMF staff estimates.
1/ Population over 65 years as a ratio of working age population (15-64 years).

the fiscal accounts are expected to be as severe as in the EU-15 in a few of the CECs, they are likely to be more moderate in most . In light of large inflows of EU funds channeled through the budget–entered above the line–and relatively favorable performance of the low deficit CECs vis-à-vis the high deficit CECs, greater fiscal convergence with EU norms is likely to prove effective in promoting growth and reducing vulnerabilities to large current account deficits.

II. Euro adoption: how will it contribute to the catch up?

Insofar as adopting the euro is a question of when rather than whether, the assessment of the balance of benefits and costs should focus on the possibility that any short-term costs could outweigh the long term gains. Broadly, the benefits will come from gains for growth from increased trade, lower transactions costs and a framework for policy discipline; the costs will stem from the loss of monetary policy independence in the event of asymmetric shocks. This section assesses this balance, concluding that even though a single metric for comparing gains and costs is not available, gains appear likely to exceed costs. This conclusion supports the view that euro adoption as soon as the policy preconditions can be put in place would be a significant boon to the EU wide goal of expediting CEC income convergence.

Benefits

Gains from participation in the euro area will come through a number of channels that differ widely in terms of likely strength and amenability to quantification. The most important will be through trade creation and attendant effects on income. An active area for current research, these gains are quantifiable even if controversy reigns over their exact size. The evidence on gains from other sources–in particular from the elimination of risk premia on interest rates, lower transaction costs, increased transparency in intercountry price comparisons, greater competition in goods and factor markets, and the discipline of the euro area's macroeconomic policy framework–is more scanty. Indeed it is not even clear to what extent these effects are alre-

ady captured in estimates of the gains for income through trade creation.

A spate of literature in the past few years suggests that the effects of currency unions on trade are positive and significant, though estimates of size vary widely. The studies spearheading this effort—Rose (2000) and Frankel and Rose (2002)—suggest startlingly large effects. Their results from estimating a gravity model on a large panel data set suggest that membership in a currency union triples trade with other currency union members compared to trade among non-members, without causing significant trade diversion. Using these estimates, together with an estimate of the influence of trade creation on growth, they conclude that EMU membership would boost per capita GDP by 20 percent in Poland and 35 in Hungary over two decades. Subsequent studies by other authors have found smaller, albeit still sizable effects. Rose (2002) examines 24 such studies and calculates a pooled estimate that currency unions double trade with union partners with even the lowest estimate affirming that currency unions raise trade between members by 15 percent. More recent studies on the as-yet short experience of the existing euro area countries suggest trade gains if extrapolated over a 20 year period roughly conforming to the average results from the larger panel data studies (DeNardis and Vicarelli, 2003, Barr and others, 2003, Micco and others, 2003, and Faruquee, 2004).

Notwithstanding the uncertainty that still surrounds the effect of currency union on trade, estimated ranges of such effects for the CECs after euro adoption can be large. Table 2, which draws on estimated parameters from a variety of studies, shows euro area membership raising trade by between 6 and 60 percent (in the CECs excluding the Baltics) over 20 years, except in Poland: there, owing to a smaller ratio of total trade to GDP than in the other CECs, estimates are lower. This is consistent with estimates of actual trade gains during the first five years of EMU (Faruquee, 2004).As such it is quite conservative for two reasons. First, these actual gains are assessed after only five years of EMU's existence—estimate using non-EMU data focus on substantially longer gestation periods when deeper effects of restructuring are likely to produce larger gains. Second, the range of trade gains among EMU countries is large—from 6-15 percent—and with more flexible economic structures, CECs may expect to be toward the top end of this range even after only five years. Using the estimates of Frankel and Rose that income will rise

by one-third of the increase in trade, a reasonable range for the impact on per capita income is 2-20 percent, with lower estimates for Poland. Estimates by Magyar Nemsity Bank (MNB, 2002) and the National Bank of Poland (NBP, 2004) fall in similar ranges.

Table 2.
CECs: Potential Long-run Increases in Trade and Per Capita Output after Euro Adoption (in percent of GDP)

	Trade	GDP	Trade	GDP
	High estimate		Low estimate	
Czech Republic	60	20	7	2
Hungary	55	18	6	2
Poland	25	8	3	1
Slovak Republic	59	20	7	2
Slovenia	53	18	6	2

Where in the range of estimates the actual effects of joining the euro area will be for the CECs will be determined by a confluence of factors, including policy influences on factor and firm mobility. Faruquee (2004) finds evidence of considerable country specific dispersion around the average EMU effect, reflecting a number of factors including the size of trade relative to GDP—a proxy for the outward orientation of a country's producers—and the composition of trade. Countries with above-average shares of intra-industry trade tend to have experienced above-average trade gains. Thus for CECs, where openness to trade and the share of intra-industry trade tends to be relatively high, trade gains from joining the euro area could be skewed toward the upper end of illustrative ranges.

A key question, however is whether the benefits of a currency union for trade stem simply from eliminating exchange rate volatility. Recent work has been rather ambiguous on the significance and size of the effect of exchange rate volatility on trade. Two recent studies, Bacchitta and van Wincoop, 2000 and Clark and others, 2003 find no evidence from a time series data set that exchange rate volatility influences trade flows. But studies using other methodologies—Broda and Romalis (2003) correcting for reverse causality in time series data and Dell'Ariccia (1998) Taglioni (2002) using panel data—find evidence of significant positive and in the latter two cases, fairly sizable effects of exchange rate volatility on trade. These results

suggest that the elimination of exchange rate volatility is an important source of the trade and income gains from a currency union.

But do the effects of currency unions on trade and income stem from more than this? Results from Frankel and Rose (2002)—including variables for both the existence or other wise of a currency board and a currency union—suggest that the currency union effect on trade goes beyond simply the removal of exchange rate volatility. Perhaps by eliminating all future uncertainty about exchange rate changes, incentive for investment are improved.

Beyond trade creation, sharing a common currency can be expected to have other benefits that are even more difficult to quantify. Some may even inadvertently be captured in estimates of trade-enhancing effects.

- Elimination of exchange rate risk should lower real interest rates by reducing the probability of shocks to the financial sector caused by contagion. The MNB and NBP estimate that lower risk premia following the euro changeover would raise growth by about 0.1-0.2 percent per year over the long term through the interest rate channel.
- Euro adoption will lower transaction costs, but estimates of this effect are generally small. In 1990 the European Commission estimated the potential savings on transaction costs through elimination of national currencies at about 0.4 percent of EU GDP (EC, 1990). Savings should be larger the smaller the country. Borowski, 2003 and MNB, 2002 estimate that euro-area membership would result in savings on transaction costs equivalent to about 0.2 percent of GDP for Poland and Hungary.
- Eliminating the potential for exchange rate swings should improve the attractiveness of the CECs as platforms for FDI, particularly in sectors open to trade. This effect would come on top of the effects of EU membership, but may be captured implicitly in the estimates of trade creation. The UK treasury study "EMU and the Business Sectors" (2003a) could not identify a clear, separate effect of euro area membership on FDI for the existing EMU countries.
- Joining the euro area would secure a clear framework for macroeconomic policy discipline. As with effects on FDI, distinct policy credibility effects on growth have generally not

been identified. They may therefore be one of the influences that implicitly contributes to the trade creation effect of currency unions.

Costs

The principle economic costs of joining a currency union typically are seen to stem from the effects of giving up an independent monetary policy on the stability of growth and inflation. A long tradition of assessing these costs exists in the optimum currency area (OCA) literature, which began as an analysis of the characteristics of countries that would be well-suited to forming a currency union but has evolved into an examination of the effectiveness of monetary policy.

The early OCA analysis focuses on criteria for defining OCAs in terms of two attributes: susceptibility to asymmetric shocks and the efficiency of mechanisms other than monetary policy for adjusting to shocks (Mundell, 1961; Kenen, 1969). They conclude that a country is better suited to currency union (i) the more similar its structure of production to that of the union and the greater its product diversification—attributes that reduce a country's susceptibility to asymmetric shocks; and (ii) the more flexible are its wages and prices and the more mobile its labor force—attributes that determine a country's capacity for adjusting to asymmetric shocks in the absence of exchange rate changes. The value of an independent monetary policy is also viewed as less important for countries highly open to international trade, where the effects of monetary policy are likely to be blunted by demand spillovers to trade and a relatively small nontradables sector.

Views on the role of monetary policy have changed profoundly since the early OCA literature, generally weakening the case for an independent monetary policy even in the absence of strong OCA characteristics. From a long-term perspective, it is now widely agreed that monetary policy cannot exercise any trade-off between inflation and growth—long-run Phillips curves are vertical. Indeed a credible imported monetary policy may reduce the costs of achieving and maintaining low inflation. And even from a short term perspective, monetary policy is seen

as effective in countering shocks only in certain circumstances. Most evidence suggests that exchange rate changes are better suited to countering demand than supply shocks (although this depends, inter alia, on whether the authorities' objective is to smooth output, absorption, inflation or balance of payments fluctuations) and then only when nominal rigidities or factor immobility exist. Fixing the exchange rate also limits the scope for capital market shocks to translate into relative price changes (Flood and Rose, 1995; Jeanne and Rose, 1999). These considerations suggest that, even apart from the traditional OCA criteria, a small, open economy that has fiscal and structural policies compatible with a currency union may lose little by giving up its exchange rate instrument while gaining monetary policy credibility and protection from financial market shocks.

It is also increasingly recognized that OCA characteristics are not static. By increasing trade links, joining a currency union may change the structure of a country's trade making the country more or less susceptible to asymmetric shocks—the former if it leads to greater specialization of production and interindustry trade (Krugman, 1991c; Artis, 1991), the latter if it leads to more intra-industry trade (Frankel and Rose, 1996). Empirical evidence on which of these effects will dominate is tilted toward greater intra-industry trade and rising correlation of shocks. Similarly, a country may become better suited to a currency union after entry if loss of the exchange rate instrument stimulates adjustment through other channels, such as wage and price flexibility (Calmfors and Johansson, 2002). Thus, while assessments of susceptibility and adaptability based on historic data remain the gold standard for membership in a currency union, they are also subject to the Lucas critique.

Susceptibility criteria

For the most part, empirical evidence does not reject the contention that on susceptibility criteria the CECs are no worse a fit for the euro area than most of the non-core EU-15.[2] These conclusions come from assessments of three types of measures of susceptibility to asymmetric shocks: direct correlation of shocks; correlations of

growth rates of economic activity, which capture both asymmetric shocks and asymmetric policy responses to symmetric shocks; and measures of structural features of economies that make them more or less prone to asymmetric shocks of asymmetric responses to shocks.

Recent evidence points to low, but rising correlations of shocks between the CECs and the euro area. Results of two studies (Fidrmuc and Korhonen, 2002; Frenkel and Nickel, 2002) using VAR models that distinguish between supply and demand shocks suggest that (i) correlations of shocks between the CECs and the euro area as a whole vary markedly but, for the most part, are low relative even to the non-core euro-area countries; (ii) for all countries, but especially for the CECs, correlations of supply shocks are substantially higher than correlations of demand shocks; and (iii) the correlations of supply shocks appear to be rising over time.[3]

Correlations of GDP and industrial production growth rates between individual countries and Germany (as the residual comparator) reinforce these conclusions. These correlations (Schadler and others 2004) also vary over quite wide ranges but at least in Hungary and Slovenia are as high as in several of the core and noncore euro-area countries. Moreover, results from sub periods suggest that correlations in all the CECs are rising. Presumably, this reflects the diminution of transition-related shocks as economic integration with the euro area deepened via trade, FDI and financial market integration.

Measures of structural similarities between the CECs and euro area also reveal increasing convergence. For each CEC, the share of intra-industry trade (measured at the two-digit SITC level) in total manufacturing trade has risen sharply since the early 1990s. As of 1996-2000, indices stood at levels comparable to those in the euro-area core and well above the noncore. Although sectoral distributions of employment and GDP continue to differ quite widely between the CECs and the euro area (industry being substantially higher and services lower), the sectoral compositions of manufacturing sectors look quite similar.

2. For this discussion euro area countries are classified as core – Austria, Belgium, France, Germany, Italy, Netherlands– and non-core or periphery –Finland, Ireland, Greece, Portugal and Spain.

3. For details see Schadler and others (2004).

Adaptability

Countries' adaptability to asymmetric shocks after euro adoption will depend primarily on wage and price flexibility and the ability to use fiscal policy countercyclically. The latter will be particularly important in response to demand shocks such as credit booms. But for supply-side and many other types of asymmetric demand shocks, wage and price flexibility will be critical to ensuring adequate competitiveness while avoiding rising unemployment.

There are reasons to be reasonably optimistic, but not complacent, about the flexibility of wages in the CECs. Large variations in inflation and productivity growth make it difficult to estimate directly how responsive nominal wages in the CECs have been to supply or demand shocks. The most promising approach, therefore, is to assess the responsiveness indirectly by examining whether labor market institutions and regulations are likely to produce wage flexibility.

- Employment protection legislation, which can hamper wage adjustments by increasing job security and making it more difficult for employers to resist wage demands, is less strict in the CECs, except Slovenia, than in most euro area countries.
- Wage bargaining in the CECs, which occurs primarily at the enterprise level, is less centralized in the CECs (except in the Slovak Republic) than in most of the euro area countries. Generally a moderate degree of decentralization produces the greatest flexibility in wage setting (Calmfors and Driffill, 1998). Moreover, in all the CECs, including the Slovak Republic, labor unions typically have a moderate effect on wage bargaining by comparison with unions in the euro area. (Crowley, 2002).
- The level of legally-binding minimum wages relative to the average wage—a measure of the degree to which minimum wages are a constraint on wage negotiations—is generally considerably lower in the CECs than in the euro area countries.

Evidence on price flexibility in the CECs is even scarcer. Product market reforms have relaxed market entry and exit conditions, probably contributing to price flexibility (EC, 2002). Moreover, endogenous changes after joining both the EU and, in the future the euro area, could change the landscape noticeably as increased trade ties and greater transparency in international price comparisons increase

price flexibility.

While wage and price flexibility are critical for adjusting to shocks with medium- and long-term effects, the size and timely operation of fiscal stabilizers are critical for smoothing the effects of shocks with short-term effects. Rough estimates suggest that automatic fiscal stabilizers in the CECs could be significant, though smaller than in the existing euro area. Estimates reported in Schadler and others, 2004 indicate that the automatic fiscal stabilizers in the CECs would be expected to neutralize 15-20 percent of the effect of demand shocks on output (the higher end of the range reflecting Poland's less open economy). This is slightly below the average estimates for the EU, which suggest that 10 percent of an export or investment shock and 25-30 percent of a consumption shock would be neutralized by automatic stabilizers (Brunila, Buti, and in 't Veld, 2002).

Putting the Pieces Together—Results of a Cluster Analysis

The broad picture that emerges from the susceptibility and adaptability measures is that CECs fulfill most of the OCA criteria about as well as the noncore euro members. But the indicators are not uniform and the piecemeal analysis does not lend itself to a summary analysis. For this purpose a cluster analysis, that identifies, according to a well-defined statistical criterion, countries that form relatively homogeneous groups in relation to the joint set of OCA criteria, is instructive. The methodology and results for five NMSs—Czech Republic, Hungary, Poland, Slovak Republic and Slovenia—are described in detail in Schadler et al. Highlights are reported here.

Broadly, four groups of countries emerge from the analysis of three measures of susceptibility to asymmetric shocks; some splintering of those groups occurs when a measure of adaptability to shocks is added to the mix. (Figures 9 and 10) In the first step, countries are grouped according to three measures of susceptibility to shocks: correlations of growth rates of industrial output for each country with the comparator (Germany); a measure of the asymmetry of the sectoral composition of the manufacturing sector vis-à-vis the average for the euro area;[4] and a measure of the importance in total trade

4. Asymmetry is measured as the sum of the absolute values of the differences between the shares of gross manufacturing output by sector and the EMU-weighted average.

of intra-industry trade. Each is measured for a recent, though, owing to data limitations, not identical, period. Four groups with statistically different averages across the three measures are identified: a core group (Austria, Belgium, France, the Netherlands, Italy, Spain, and Hungary), a northern periphery group (Finland and Ireland), a Southern periphery group (comprising only Greece); and a CEC-dominated group (Czech Republic, Poland, Slovak Republic, Slovenia and Portugal). Note that Hungary falls into the core, rather than the CEC, cluster. Broadly, the CEC cluster is quite similar to the core cluster on the basis of manufacturing structures and intra-industry trade, but has a substantially lower output correlation than the other clusters. As the former two are probably leading indicators of a future strengthening of output correlation, this pattern suggests that the countries may not continue to exist as a cluster distinct from the core for long.

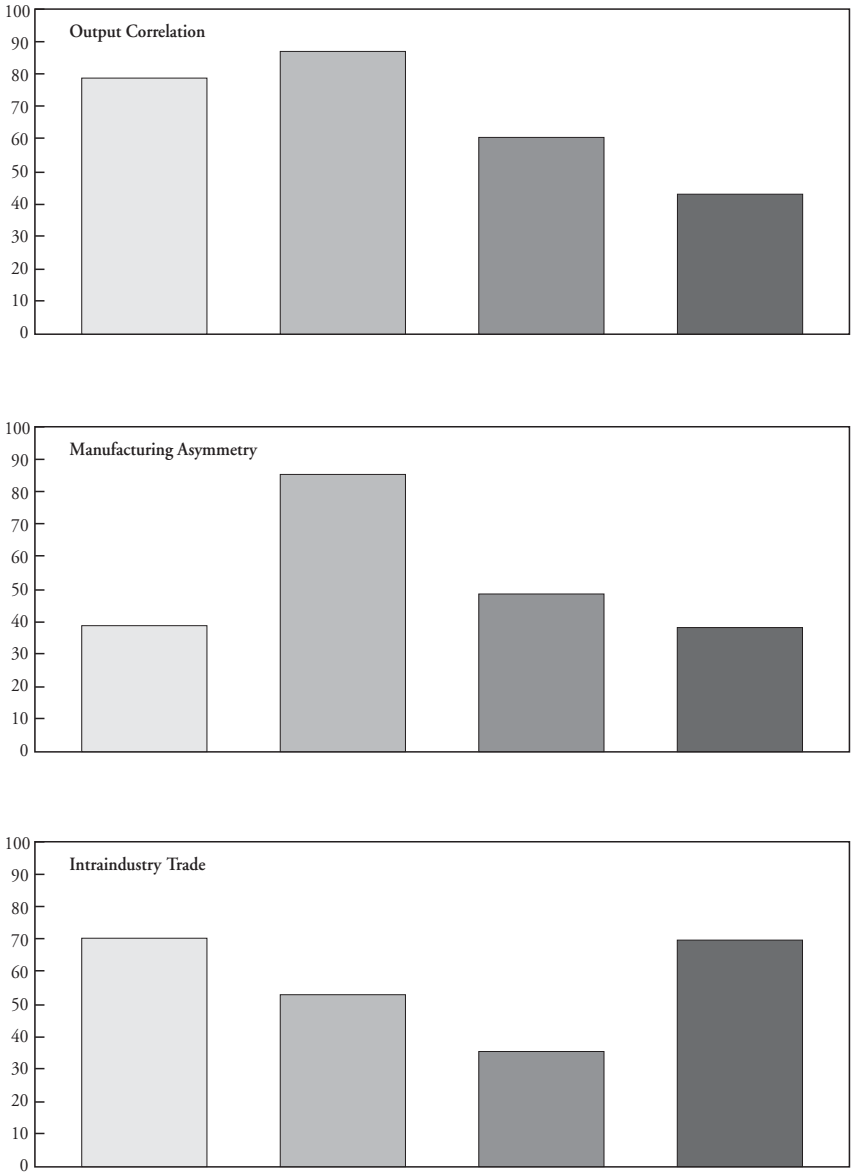
Adding the only readily available adaptability measure—the OECD index of employment protection—to the analysis, changes the picture only marginally. Each of the clusters from the susceptibility analysis splinters (Figure 10). But the basic resemblance of the CECs (now without Portugal which becomes more similar to the stricter employment protection category of Greece) to the core remains in tact: employment protection levels in the CECs are similar to those in the core, while Slovenia becomes a cluster on its own owing to higher employment protection than in the other CECs. Hungary remains in the cluster with the larger core group.

Taken together, the assessments of the standard OCA criteria of susceptibility and adaptability to shocks present a picture of relatively strong similarities between the CECs and the euro area as a whole, but particularly the core countries in the euro area. That these similarities were evident even in data from the late-1990s and that the indicators of structural similarities were closely matched with the core, suggests that more up-to-date data may even reveal a picture of stronger similarities.

How Valuable is an Independent Monetary Policy?

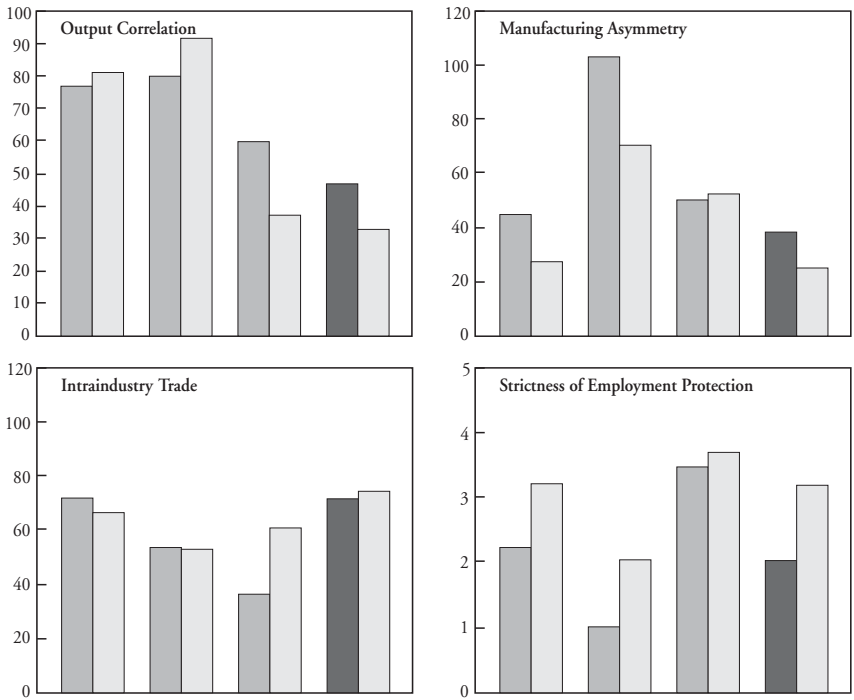
The OCA criteria do not make a compelling case for the need for an independent monetary policy. They do not, however, allow for a direct comparison of macroeconomic stability inside versus outside

Figure 9.
Cluster Analysis: Group Means of Susceptibility Measures



- **Austria, Belgium, France, the Netherlands, Italy, Spain and Hungary**
- **Finland and Ireland.**
- **Greece.**
- **Czech Republic, Slovak Republic, Slovenia, and Poland. Excludes Hungary, wich is clustered in the core.**

Figure 10.
Cluster Analysis: Group Means of Susceptibility Measures



Austria, Belgium, France, the Netherlands, and Hungary; Spain and Italy; Ireland; Finland; Greece; Portugal; Poland, Slovak Republic,and Czech Republic; Slovenia

the currency union. For this, a general equilibrium model is needed to simulate the response of policies and macroeconomic developments to similar underlying exogenous states of the world when a country has adopted the euro and when it has not.

To this end, the effects of joining the euro area on output and inflation volatility are examined in the IMF's Global Economic Model (GEM) calibrated on the euro area and an economy with key features of the CECs (Laxton and Pesenti, 2003 and extensions thereof).[5] This typical CEC economy (modeled after the Czech Republic) is small, has more flexible wages and prices that the euro area, is more open to trade, and is more susceptible to shocks, parti-

5. The GEM has several appealing features for this purpose. It is built on optimizing behavoir of firms, households and the monetary authorities, and it can capture many features of the CECs vis-à-vis intrau¡industry trade with the euro area and differentiated productivity shocks.

cularly to risk premia and productivity. The model is used to derive a schedule of the feasible trade-off between output gap and inflation variability under the current floating rate regime and under participation in the euro area. The latter is characterized not only as fixing the exchange rate but also as eliminating foreign exchange market risk premium shocks and accepting a monetary policy based on a Taylor rule defined over the weighted average output gaps and inflation rates of the enlarged euro area.

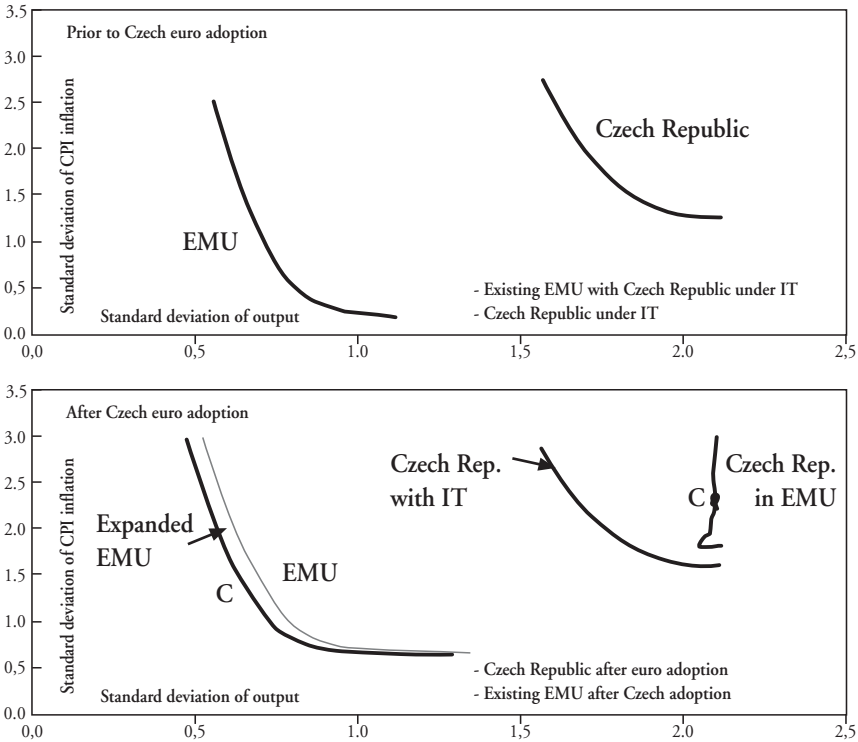
The results of the simulations indicate that, while the addition of the Czech Republic-like country to the EMU improves the output gap-inflation variability trade-off for the expanded EMU, it worsens it for the Czech Republic. With the Czech Republic outside the euro area, the TEF (the locus of possible trade-offs of output gap and inflation volatility) is worse (further to the right) in the Czech Republic than in the euro area (Figure 11). After the Czech Republic joins the euro area, the expanded EMU TEF shifts slightly to the left, owing to the elimination of risk premia shocks to Czech assets held by euro area residents and the presence of some negative covariances between Czech and euro-area inflation and output. But the TEF of the Czech Republic shifts to the right, reflecting the change to a monetary policy responding to area-side shocks. Moreover, the Czech Republic in this setting is no longer able to choose its point on the TEF according to its own preferences.

While no metric exist for measuring the size of the welfare loss from this shift in the TEF, calculations of a representative increase in volatility resulting from the regime change suggest it is small. Analyzed at a point like C, the shift would lead to a rise in the standard deviation of the output gap (around its mean) from about 1.7 percentage points to 2.1 percentage points and of inflation from 1.9 to 2.1 percentage points. This means that with a two thirds probability, the Czech output gap under EMU would lie in the range of ± 2.1 percentage points around potential, compared with ±1.7 percentage points under inflation targeting. Inflation under EMU would be in the range of 1.1-5.1 compared to 1.3-4.9 under inflation targeting.[6]

The role of assumptions about the economic environment–which as pointed out in the previous section may be endogenous to joining the euro area–is critical to these conclusions.

6. This assumes average Czech inflation under inflation targeting and EMU is 3 percent.

Figure 11.
Euro Area and the Czech Republic: Feasible Combinations of Output and Inflation Variability Under Alternative Monetary Policy Arrangemente 1/



1/ Taylor efficiency frontiers and schedules.
Sources: Laxton and Pesenti (2003); and IMF staff calculations

- A doubling of the standard deviation of assumed risk premium shocks would move the IT Czech TEF to the right. The shift could be large enough to leave a sizable portion of the TEF under EMU to the left of the IT TEF
- If joining the EMU were to lower the size of asymmetric shocks in the Czech Republic, this would tend to shift the TEF under EMU for the Czech Republic leftwards.
- Structural policies and conditions as the CECs approach euro adoption will be critical: any increase in nominal rigidities if these countries become more like the EU would shift the TEF rightwards. But if in the absence of the exchange rate instrument, nominal flexibility in other areas tended to rise, the TEF

after euro adoption would tend to be to the left of that shown in the figure.

- This exercise assumes that actual macroeconomic policies while the Czech Republic is outside the euro area are optimal and keep the country on the lowest possible TEF. This may, however, not be the case. And if the euro area macroeconomic framework improves policy discipline, the shift from a point to the right of the IT TEF to a point on the new TEF may even be a leftward shift.

Ideally the long-term benefits and costs of euro adoption would be combined in a single metric to determine the net gain or loss. However, no such single metric exists, and any conclusions on net benefits rest on judgment about how to weight possible benefits for trade and growth and possible costs of greater macroeconomic volatility. For the CECs, the evidence suggests that the growth dividend coming from an expansion of trade alone will be sizable, while rough calculations of the size of possible volatility seem small. It is therefore reasonable to conclude that securing the gains as early as possible, particularly if combined with maximum efforts to improve structural flexibility and rein in fiscal deficits, would be the growth-and-welfare-enhancing course.

III. Pitfalls on the Path to Euro Adoption

Any major monetary regime change involves risks, and the move through ERM2 to euro adoption is no exception. The risks of greater economic volatility were discussed in the previous section. At least as important, however, are the financial sector dimensions of these risks: each country has developed a strategy for dealing with the substantial financial sector risks of an emerging, post-transition market. For the Baltics currency boards or a hard peg are central to this strategy. But for the other CECs (called here for convenience the CEC5), which have strategies based on exchange rate flexibility, at least parts of these strategies will need to change radically to meet the test of ERM2 and eventually adopt the euro. The CECs will need, therefore, to consider whether the regime transition risks are best taken on in the near term or later, after further financial sector deve-

lopment. In turn they will need to devise strategies for dealing with these risks.

Several types of risks will characterize ERM2 participation and post euro adoption life for the CECs. Any country joining a currency union faces the risk of choosing the wrong parity. This issue, covered extensively in Schadler et al. (2004), is largely the same for transition countries and others joining a currency union. The unique issues for the CECs arise from financial sector characteristics: unusually large and volatile capital flows and low rates of bank intermediation which suggest that the possibility of rapid growth of bank lending is sizable. This section examines the risks from these sources, considers whether argue for delaying euro adoption (or even entry to ERM2) and suggests strategies for risk management to replace exchange rate flexibility.

Capital Acount Volatility

The gaps between estimated marginal products of capital in the CECs and in their main European trading partners mean that large, and therefore potentially volatile, capital flows will be a fact of life for the CECs for many years to come. There is therefore little reason to consider delaying euro adoption on concerns about the size and volatility of inflows.

It will be important, however, that each country have a clear and coherent strategy for addressing risks of capital account volatility and that these strategies recognize the discontinuities involved in moving through ERM2 to euro adoption. These strategies must take into account that the move to euro adoption—specifically participation in ERM2—may even increase capital account volatility. Three influences will be important.

- **Terminal date risks**. Markets have already formed, and will continuously revise, expectations about the terminal date of euro adoption. The expected terminal date, together with a credible central parity, will anchor the path for interest rates and market exchange rates to converge to euro-area interest rates and conversion rates respectively. Changes in expectations about the terminal date—owing for example to revisions in perceptions about a country's ability to meet the Maastricht criteria by a certain time or even contagion from changes in

such perceptions about other countries—would have potentially large effects on capital flows and/or the market exchange rate.

- **Risks from asymmetric shocks.** For most shocks, serious risks would arise only if policies are insufficiently responsive and monetary frameworks insufficiently clear about how disruptions to financial conditions will be absorbed. In short, in the face of a shock with potentially significant effects on capital flows, credible mechanisms for allowing either exchange rates or interest rates to adjust are essential. In practice, most shocks can be addressed within any clearly defined monetary framework that leaves little doubt in the market about the credibility of the policy response. ERM2 could weaken this credibility if it were perceived as limiting the scope for exchange rate changes beyond the capacity of other macroeconomic policies to support.
- **Risks from policy inconsistency.** The 1992-93 ERM crisis showed the rigor the market will bring to the evaluation of policy consistency. Strains on the Hungarian forint in 2003, when an ambitious inflation target came into conflict with an exchange rate at the top of its band, suggest that the CECs will face equally strong market scrutiny. Such risks, of course, loom over all countries regardless of their monetary frameworks, but the CECs could face a particular challenge while steering their economies toward the Maastricht criteria. Specifically, the combination of an ambitious inflation target and an actual or perceived narrow exchange rate band—asymmetric or not—could be prone to problems of credibility.

The importance of devising a new strategy—embodied in a clear monetary framework—for dealing with potential capital market volatility in ERM2 cannot be underestimated. At present most CECs have chosen one of the safe "corner solutions"—freely floating exchange rate with inflation targeting or a hard peg/currency board—to protect themselves from risks of capital market volatility. The hard peggers are likely to have a relatively seamless passage through ERM2 to euro adoption: the inflation targeters will face more exacting changes. For these countries the free float and absence of significant discretionary intervention has been a key part of their strategy for managing risk: they have (largely successfully) discoura-

ged excessive unhedged foreign currency positions and prevented central banks from getting caught on one side of speculative pressures. Once these countries have adopted the euro they will have equally sound protection—the euro—from the risks of capital account volatility. The key for them is to find equally sound strategies for ERM2 compatible with meeting the Maastricht criteria.

A major challenge will arise from the fact that in ERM2 monetary policy will have multiple objectives: controlling inflation, maintaining competitiveness, and meeting the exchange rate stability criterion. Also, the choice of a monetary policy framework will not be unconstrained: ERM2 requires that a central parity against the euro be maintained, while unilateral euroization, free floats, pegs to currencies other than the euro, and crawling pegs are ruled out.[7] Finally, as emerging market economies facing large and volatile capital inflows, the CECs will need to be mindful of the risks of fixed- but adjustable pegs: specifically, that following a shock, markets will perceive that defense of the peg is not the highest priority of the government.[8]

These considerations suggest two options for ERM2 that would offer the protection of "corner solutions" while remaining consistent at least with the spirit of the Maastricht criteria.

- **Effectively operating a hard peg at parity during ERM2.** Countries may wish not to formally institute a currency board for a two-year stay in ERM2. But communications with markets and responses of interest rate and other macroeconomic (particularly fiscal) policies would need to be similar to those under a currency board to establish the credibility needed to weather shocks affecting capital flows. In essence this could be seen as foregoing the very narrow scope for flexibility provided by exchange rate criterion (±2 $^1/_4$ percent around parity) in return for improved credibility. In view of the scope for inconsistency between the exchange rate and inflation rate criteria and the need to maintain competitiveness, fiscal policy would have to be as disciplined as under a successful currency board. The greater the gap between this arrangement and that of a for-

7. Monetary policy frameworks subsume an exchange rate regime. for brevity, therefore, "monetary policy framework" refers to the joint choice of monetary and exchange rate operating mechanisms.

8. Obstfeld and Rogoff, 1995 make the conceptual case for this conclusion, which is supported empirically by Bubula and Otker-Robe, 2003.

mal currency board, the stronger the case for limiting the stay in ERM2 to the two-year minimum.

- **Exchange rate targeting without narrow bands.** In this arrangement interest rate and fiscal policies would aim to stabilize the exchange rate at parity over, say, a two year horizon. To eliminate the perception of an implicit narrow band and encourage hedging, ex ante commitment to flexibility of the exchange rate on both sides of parity and to interpreting the Maastricht exchange rate criterion flexibly would be essential. Thus, any shock might initially move the exchange rate—even quite significantly—within the + 15 percent band, but fiscal and monetary policy would then be adjusted to guide it gradually back to parity. Inflation would be a key secondary objective, but increasingly subordinated to the exchange rate target if and as the market rate moved away from parity. To avoid any signal of implicit bands, foreign exchange market intervention would be minimal. The objective of this arrangement would be to maximize the magnet effect of a well-chosen parity. Paradoxically, barring major asymmetric shocks, this arrangement could produce exchange rate behavior in line with the narrow interpretation of exchange rate stability, especially as the conversion date approached.

Credit Booms

Rapid credit growth looms on the horizon for each CEC; for most it has already started. Prospects for strong permanent income growth, low private sector indebtedness to resident banks and ample investment opportunities, will inevitably combine with improving risk assessment techniques of newly privatized banks to produce rising growth of bank credit to the private sector (BCPS).

Some changes that will accompany euro adoption could hasten this process. The effects of euro adoption on growth and investment will of course be important demand side impetuses. Also the fall in risk premia will push down the cost of foreign borrowing by banks in the CECs, allowing them to fund more rapid credit expansion from abroad; lower bank lending to governments attendant on fiscal retrenchment will crowd in lending to the private sector; and after euro adoption, euro area interest rates, alongside structurally high

inflation in the CECs, are likely to translate into low or even negative real interest rates, especially vis-à-vis nontraded goods. A critical question in decisions on the timing of euro adoption is whether independent monetary policies are needed until BCPS has risen closer to euro area levels and the risks of credit booms has receded.

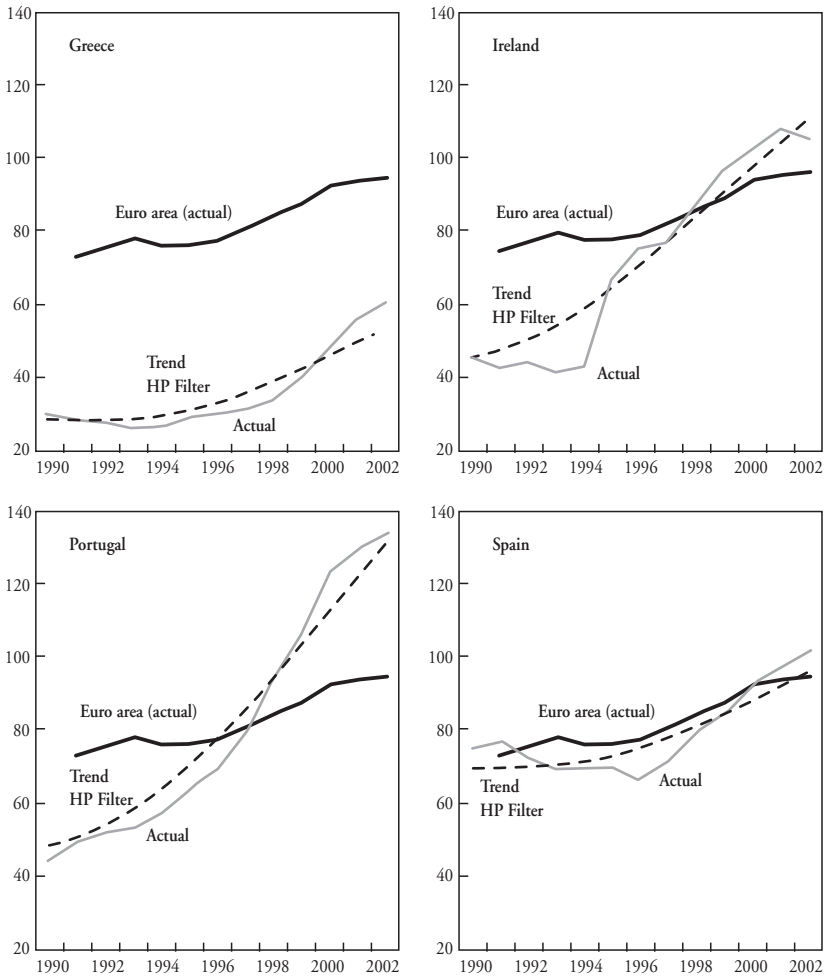
Insofar as this is uncharted territory for the CECs, the experience of existing euro area countries that also started with low BCPS ratios provides the best guide for the CECs. Rapid growth in BCPS began in several of the non-core euro–area countries about five years before euro adoption and continued after euro adoption. Growth rates were dramatic, pushing BCPS ratios substantially above the euro area average in Portugal and, to a lesser extent, Ireland (figure 12). Some changes in policies and perceptions owing to prospective euro adoption undoubtedly contributed: governments reduced borrowing requirements, interest rates fell and prospects for growth improved. But other policy changes, unlikely to be present in the CECs, also played a role: in particular, deregulation of domestic financial sectors in the early 1990s set the stage for more dynamic lending and an increase in foreign borrowing by banks.

Real interest rate developments after euro adoption continued to support private credit growth. Lending rates remained broadly at levels of the core euro area countries, while inflation rose reflecting the full influence of B-S-induced real appreciations under exchange rage fixity and buoyant cyclical positions (figure 13)

BCPS ratios in Ireland and Portugal well above euro area levels have raised concerns about the future health of their domestic banks. But standard indicators of bank soundness remain strong overall: nonperforming loans relative to total loans have remained broadly stable since 1999; and average risk-based capital adequacy ratios remain above—in some cases well-above—the BIS recommended minimum (although the ratio has fallen in Portugal). Nevertheless, in both Ireland and Portugal the concentration of bank exposure to real estate is a concern: property related loans account for more than 40 percent of total BCPS compared to 28 percent in the euro area as a whole. While housing price increases in Portugal have been quite modest, real house prices have risen by over 130 percent since 1993 in Ireland.

Heuristically, it would seem reasonable to expect BCPS in the CECs to rise at rates somewhere in the middle of the range circumscribed by Greece on the low side and Portugal on the high side. Most

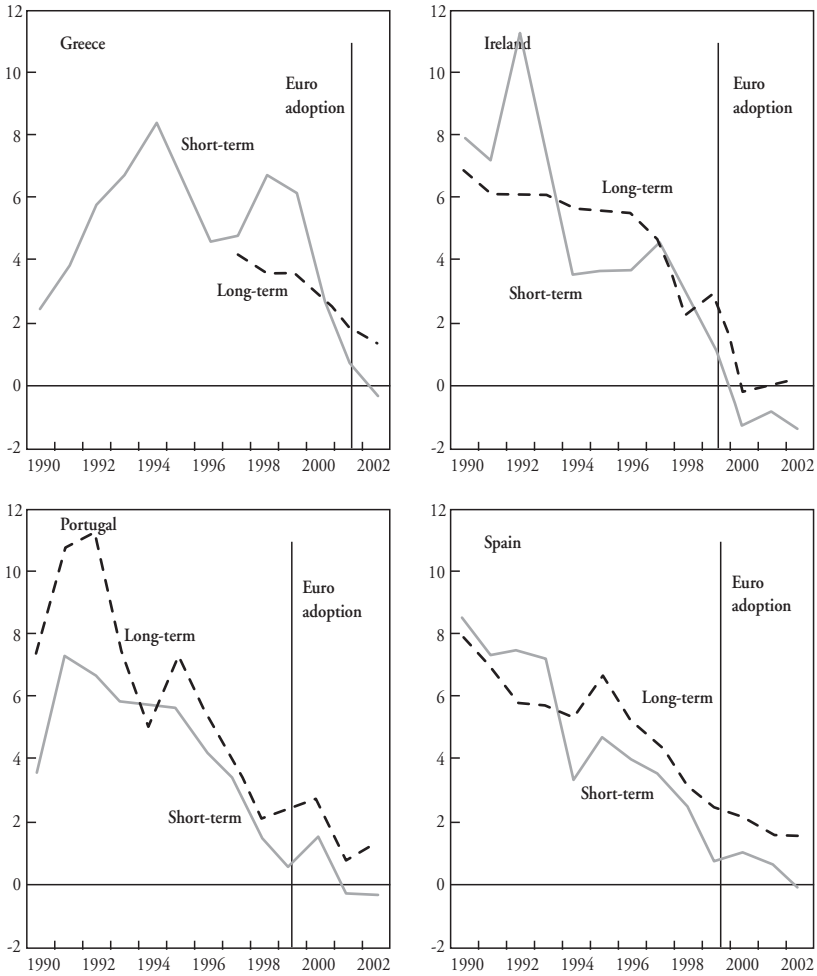
Figure 12.
Selected Noncore Euro-Area Countries:
Bank Credit to Private sector, 1990-2002 (In percent of GDP)



Sources: Eurostat; IMF, *International Finance Statistics*; and IMF staff calculations

of the CECs start with BCPS ratios slightly below those in the four euro area countries under examination, but the gap between their per capita GDPs is considerably larger: if the pace of income catch up is inversely related to the initial gap, GDP growth would be faster and the growth of BCPS could be correspondingly greater. Similar influences on real interest rates—nominal rates at euro area levels after euro adoption but inflation rates, reflecting B-S effects, considerably higher than the euro area average—should also prevail in the

Figure 13.
Selected Noncore Euro-Area Countries:
Real Interest rates, 1990-2002 1/ (In percent, period average)



1/ Short-term rates, refer to 3-month interbank rate; long-term rates refer to 10-yaear benchmark bond yield. Deflated by CPI inflation during the preceding 12 months.

Sources: OECD; and IMF staff calculations.

CECs. One factor that weighs on the downside, however, is that most CECs already have relatively low interest rates—compared to those in Greece, Ireland, Portugal and Spain 3-4 years prior to EMU—and while BCPS growth rates have been rapid in some countries, nowhere have they yet reached the heady rates seen in Portugal or Ireland. This may reflect a legacy (from the days of central planning) of consumer, business, and bank caution with credit instru-

ments or of weaknesses in protection of creditor rights. Persistence of such a legacy could make the adjustment to higher BCPS more gradual than in the euro area. But the fact that foreign banks are now large players in CEC banking sectors, suggests that restraint is unlikely to come from the supply side for long.

In the absence of meaningful data from the CECs, any empirical estimates of future growth of BCPS must come from euro area data. Thus results of a vector error correction model (VECM) using quarterly euro area data from 1991-2002 were used to predict equilibrium values of BCPS and the dynamic adjustment path to it for the individual CECs. [9] The results offer further support for the contention that BCPS growth rates in the CECs are likely to be in the range of those in the four euro area countries with the most rapid credit expansion.

For the euro area as a whole, the model suggests that the actual BCPS ratio at end-2002 was only marginally below the predicted long-term value. But for some individual countries, the deviations were large: actual BCPS substantially exceeded fitted equilibria in Spain and, especially, Portugal, but for Ireland the deviation was minimal. Applying the same parameters to the CECs suggests that at end 2002, BCPS ratios were on average 41 percentage points below the equilibrium and varied within a narrow range.[10] This result is similar to forecasts for the CECs by Cottarelli and other (2003), based on a panel estimation from non-transition developing and industrial countries.

Results from the second component of the model–estimates of dynamic convergence paths of credit ratios to their equilibria– can be used to simulate the adjustment of credit ratios in individual countries. For the non-core euro area, the gaps between actual and simulated BCPS ratios largely confirm the earlier heuristic analysis. For Greece the credit ratio has increased more slowly than predicted by the model; for Portugal and Spain, the increase was much more rapid than forecast; and for Ireland, the increase was about as predicted.

Dynamic simulations for the CECs suggest a potentially rapid

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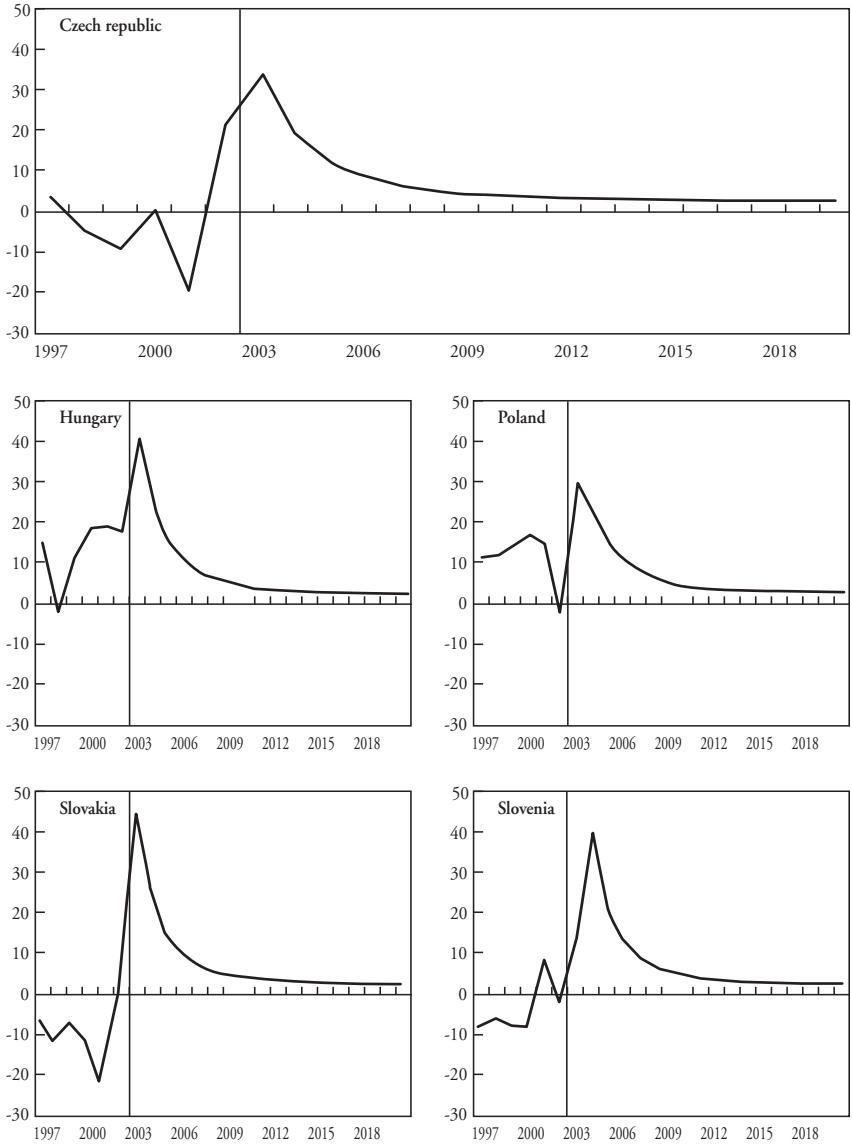
9. Empirical work is scarce on the macroeconomic determinats of bank credit in the euro area or its members. Calza and other, 2003 estimate the level of bank credit to the private sector using a VECM for the euro area as a whole, but their specification of the co-integrating relationships precludes applying the parameter estimates to individual countries.

10. Values for individual countries are evaluated at actual real interest rates and PPP CDP per capita as of end-2002.

Figure 14.
CECs: Real Bank credit Growth to the Private sector, 1997-2020 1/
(In percent per year)



1/ Nominal credit deflated by CPI; actual values for 1997-2002, predicted values for 2003-2020.
Sources: Eurostat; IMF, *International Financial Statistics*; and IMF staff calculations.

acceleration in real BCPS in the next few years (figure 14). Growth rates are predicted to peak at 30-45 percent—substantially above his-

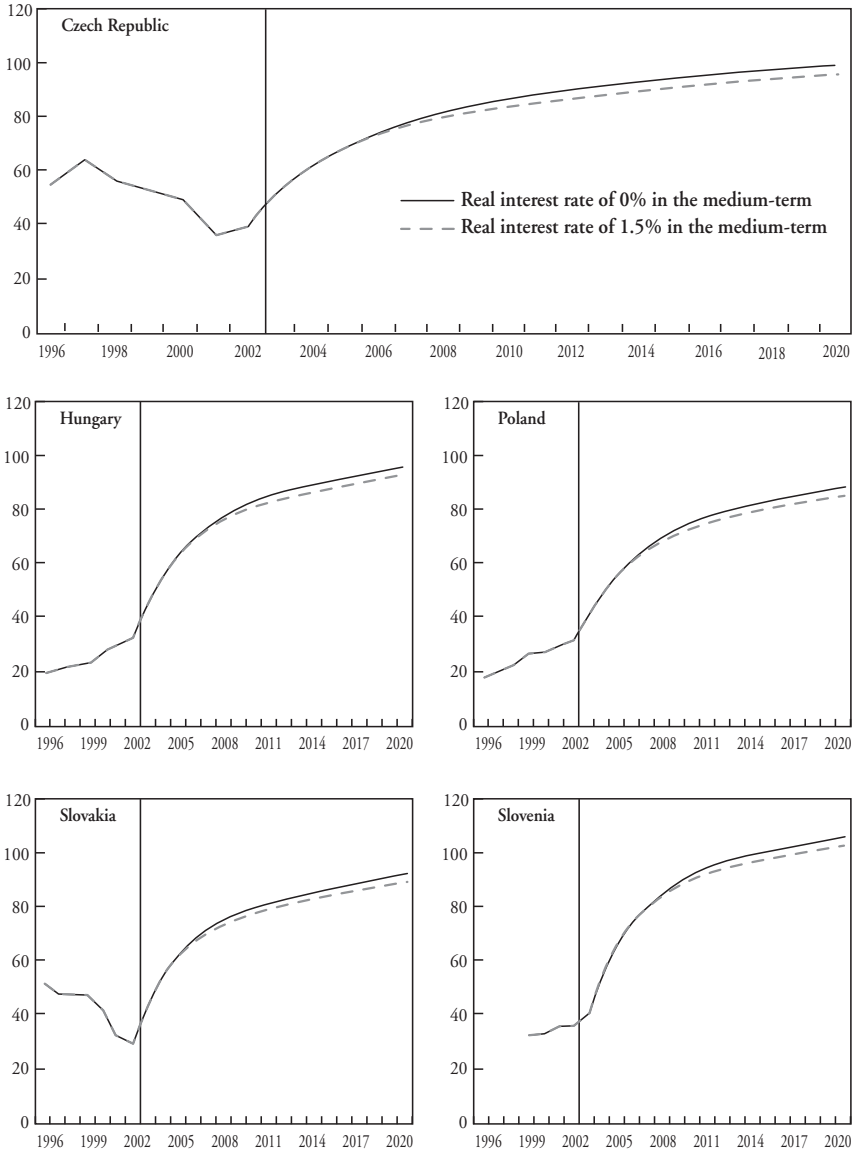
torical growth rates but below the peak growth rates recorded in other transition countries (66 percent in Ireland). By construction, the VECM model yields the sharpest increase in credit in the first year of the simulation (2003) when the BCPS ratio is the furthest from its long-term equilibrium. Growth rates return to fairly low levels within a few years.

The credit paths coming from these simulations should be seen as extreme scenarios. The VECM was estimated on the aggregate euro zone where deviations of actual credit ratios from equilibria never exceeded 10 percentage points during the sample period (although for individual countries it was as great as 50 percentage points). Using these estimates of the dynamic adjustment in the CECs, where disequilibria are considerably greater, is likely to bias the projected pace of adjustment upwards. This is especially true if institutional difference between the euro area and the CECs remain (e.g. creditor rights are less well protected in the CECs or consumers/businesses are leery of credit instruments).

Does the prospect of rapid BCPS expansion mean that an independent monetary policy should be retained and euro adoption delayed? This question should actually be asked in two parts. First, is euro adoption likely to accelerate the adjustment of BCPS to its equilibrium? And second, even if rapid credit expansion is equally likely inside or outside the euro area, would an independent monetary policy be effective in curtailing an excessive expansion?

Further estimates and simulations of the VECM suggest that euro adoption per se would add little to the underlying impetus for rapid credit growth in the CECs. The VECM was re-estimated including a variable measuring the number of quarters until the introduction of the euro. The coefficient on this term was small and statistically insignificant. This could be because the effects of approaching EMU worked primarily through the interest rate channel—falling nominal interest rates together with somewhat higher inflation as B-S effects in some countries pushed up inflation. But even a simulation assuming real interest rates converge to zero over 24 quarters (compared to about 1 $^1/_2$ percent over 12 quarters in the baseline) differs little from the baseline (figure 15). Thus, delaying euro adoption on the grounds for fear of its possible role in a credit boom would seem ill-founded. The condition that will spawn rapid credit growth–the large gap between actual and equilibrium BCPS ratios–would be little affected by euro adoption.

Figure 15.
CECs: Alternative Simulations of Bank Credit to Private Sector, 1996-2020 1/ (In percent of GDP)



1/ Nominal credit deflated by CPI; actual values for 1997-2002, predicted values for 2003-2020.
Sources: Eurostat; IMF, *International Financial Statistics*; and IMF staff calculations.

Whether a domestic monetary policy is needed to control rapid credit growth is a more serious question. But even here the case for

delay is weak. Interest rate policy in the CECs is constrained even under inflation targeting by the openness of CECs' capital markets. As Lipschitz et al, 2004 show, a high responsiveness of capital inflows to interest differentials in the CECs constrains interest rate decisions on the upside, while extremely high marginal products of capital constrain interest rate decisions on the downside. More heuristically, the experience of the past few years points to the tendency for domestic residents to borrow in foreign currency when interest rate differentials are large, especially if accompanied by appreciations of domestic currency. In short, domestic interest rate increases have not proved a powerful restraining influence on credit expansion and have tended rather to drive borrowers to foreign currency borrowing and banks to accept substantial credit risks.

The conclusion must be that other policy instruments will have to bear most of the burden of protecting against the substantial risks–for the health of the banking system and for overheating of the economy–associated with rapid credit expansion. Specifically, there will be no substitute for strong bank supervision to ensure sound loan evaluation by banks, proper provisioning against problem loans, and adequate assessment of bank credit risks. And the effects of rapid credit growth on macroeconomic performance–particularly on inflation and current account positions–will need to be countered by fiscal restraint. This is likely to mean that for the CECs to weather periods of high credit growth, fiscal deficits will need to be well-below the Maastricht fiscal criterion, perhaps even close to the SGP's medium term goal of close to balance or surplus.

Conclusions

Enlargement was a bold move that stands to add significantly to the welfare of the new member states as well as the EU-15. But realizing the goal of equalizing incomes in the old and new members will be a tough objective requiring efforts across a broad front for some time to come. Euro adoption in the NMS's could make an important contribution to this process, but the demands on the CECs are substantial.

Most indicators suggest that structurally–both in terms of susceptibility to asymmetric shocks and scope for adapting to such shocks–the CECs are a reasonably good fit for the euro area. The key

considerations, then, on the timing of euro adoption are how soon countries can put in place fiscal positions that are stringent enough to protect against inherent financial sector vulnerabilities and whether an early move (and the major regime change it entails for the countries that now have monetary policy frameworks built around flexible exchange rates) poses financial sector risks. The conclusion from considerations raised in this paper is that with appropriate policies these risks are no greater if countries move ahead with euro adoption quickly or delay it for some time. In other words the benefits are there to be had without major costs as long as countries can put in place macroeconomic policies–especially fiscal policies, strong bank supervision, and policies to ensure flexible economic responses to asymmetric shocks–that compensate for the loss of exchange rate flexibility.

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Discussion

Stephen Cecchetti thinks that it is very risky for the new countries to maintain their national currencies instead of adopting the Euro right away. The risks of the transition process (very small countries, prone to currency attacks) are too big.

Philippe Bacchetta says that new members are experiencing large credit expansions, but periods of rapid credit expansions tend to be followed by downturns and credit busts. He asks for policy recommendations to prevent this boom-and-bust cycle

György Szapáry says that markets expect quick convergence of the new members to the monetary union. He mentions the convergence in the yields of government bonds as further evidence of these expectations. However, there are some other dangers associated with this situation. A large amount of foreign money is currently invested in bonds. That means that those countries can run current account deficits that could be unsustainable in other circumstances. They can make bigger "sins" and that poses problems for the future. But the time of reckoning will appear perhaps due to an external shock, and the adjustment will be painful because the new members have less automatic stabilizers than the EU 15.

Fernando Ballabriga asks what is the main task of the 15 EU to make the enlargement a success for instance in emigration policies.

Susan Schalder stresses the fact that the EU is a rules-based institution and therefore the new members must take steps to assure their policies are consistent with these rules.

Inflation differentials in EMU: the Spanish case*

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Abstract

In this paper we present some descriptive evidence and simulation exercises with both an estimated backward looking model and a calibrated general equilibrium forward looking model that allow some light to be shed on the determinants and macroeconomic implications of persistent inflation differentials in Spain within EMU. We show that a demand expansion biased towards consumption of non-tradable goods and real-wage rigidities -such as wage indexation clauses-are among the key determinants of diverging price developments in Spain. Moreover, we find that in those conditions the stabilising mechanism of terms of trade effects is relatively weak, although the economy undergoes lasting losses in competitiveness.

1 Introduction

From the very inception of EMU, the idea that a limited degree of dispersion of inflation rates across Member States is perfectly compatible with a soundly functioning monetary union has been accepted. Indeed, regional prices do not grow at the same rate in any of

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the currently estabished currency unions. This is the consequence of shocks not affectingall regional economies at the same time or with the same strengthand/or the differentway those shocks interact with the price formation mechanism prevailing in each region. Although the standard deviation of national inflation figures in EMU is currently somewhat larger than that of regional inflation rates in both the US and in euro area countries, a number of specific factors -of mostly a transitory nature-could help explain inflation dispersion in EMU since 1999. Those are mainly changes in administered prices and indirect taxation at the national level, discrepancies in the cyclical position of each economy or differentexposure to external shocks (see ECB, 2003).

Therefore, the size of the dispersion of national inflation figures in the euro area does not seem a relevant specific feature of EMU. Yet, a more distinctive characteristic of price developments in the euro area which is now attracting muchattention in the literature and in thepolicydebateisthe persistenceofthose inflation differentials: countries with an inflation rate above or below average at a particular moment tend to remain in the same situation in the subsequent periods. By way of example, inflationincountries like Ireland, Portugal, Greece and Spain have consistently exceeded the EMU average while others like Germany and Austria have persistently remained below that reference.

In principle, persistent national inflation differentials need not be an adverse feature of a monetary union. As argued by Balassa (1964) and Samuelson (1964), this phenomenon can be associated with the process of real convergence ofcountries with lower income within the currency area.Those countries tend to experience high productivity growth in the tradable sector that would normally translate not only into higher real wages in that sector but also into higher nominalwages in the non-tradable sector thatwould imply higher aggregate price growth. There exists already some evidence that this effect canjustify relatively sizeable inflation differentials (see Alberola and Ttyrväinen, 1998) in EMU. Moreover, differencesin sectoral productivity growth seem to explain low-frequency movements in relative national price indices (see Ortega, 2003). But, based also on the latest evidence, there seems to be a growing consensus that the Balassa-Samuelson hypothesis cannot constitute a general explanation of persistent inflation differentials among

EMU members (see e.g. Alberola, 2000, Rogers, 2002 and ECB, 2003).

An alternative hypothesis to thatof Balassa-Samuelson is that persistent inflation differentials are caused by nominaland real rigidities affecting price and wage formation mechanism in combination with common or idiosyncratic shocks. This latter hypothesis has less benign normative implications than the former. As a very minimum, inflation differentials wouldin that case signalthe likely presence of structural imperfections that reduce the overall efficiency of the economy and amplify the fluctuations of the business cycle. Moreover, those rigidities may cause persistent losses in competitiveness in high-inflation countries and in-crease the likelihood of potentially damaging deflationary episodes in low-inflation countries. From a more euro-wide perspective, persistent discrepancies of national inflation figures do pose an important communication challenge for monetary authorities and complicate the design of their optimal reaction function (see Benigno, 2003 and Benigno and López-Salido, 2002). Therefore, in order to identify the appropriate policy attitude towards inflation differentials it is important to characterise the specific factors that are causing diverging price developments.

Some recent literature provides information in that regard. Honohan and Lane (2003, 2004) argue with a simple regression analysis that much of the divergence on inflation rates among EMU countries is attributable to the differential impact of exchange rate movements. In contrast, Angeloni and Ehrmann (2004), making use of an estimated two-equation model for 12 euro area countries, obtain that inflation persistence -included as an ad-hoc extraterm in an otherwise standard New-Keynesian Phillips curve- is the single most relevant explanatory factor for persistent inflation dispersion. But in the last few years several papers have also made use of micro-founded models, in the tradition of Obstfeld and Rogoff (2000)'s new open economymacroeconomics, to explore more deeply the potential causes of inflation dispersion in a currency area. Depending on the specific features of the models employed, authors are able to emphasise a type of shock and/or a specific type of rigidity that help generate persistent price dispersion across the countries of a monetary union. For instance, Andrés et al. (2003) make use of a two-country modelwhere all goods are tradable and price adjustment is costly to emphasise that price dis-

crimination may actually generate substantial price dispersion in a monetary union. In a two-sector model also with price discrimination, Duarte and Wolman (2002) find that demand shocks are less likely to generate persistent differentials than supply shocks.By contrast, Altissimo et al.(2004), in a model with asymmetric price rigidities across countries and imperfect labour mobility across sectors, and where Purchasing Power Parity holds in the tradable sector, find that demand shocks -either aggregate or idiosyncratic-can more readily generate persistent inflation differentials than supply shocks.

Therefore, theavailableevidencedoesnot yetoffer a conclusive explanation of the factors underlying persistent inflation differentials in euro area countries. In fact, it seems unlikely that all discrepancies between national inflationary processes within EMU could be caused by the same factors.As an example, there should be little hope of finding a single argument that could completely explain both the positive inflation differential of Portugal -a lowgrowth, high-inflation country -and that of Ireland -a-high-growth, high inflation country. In that regard, it may be worthwhile modifying the research focus. Instead of concentrating only on searching for a story that maximises the size or the persistence of inflation dispersion within the euro zone, we may gain from seeking the most likely determinants of the inflation differential of specific economies.

In this paper we try to follow this alternative approach by focusing on the case of Spain. We identify some stylised facts of Spanish economic developments over the last few years and investigate what could best explain its persistently positive inflation differential with the euro area average. We also try to understand better the adjustment mechanism of this economywithin EMUand formulate some policy prescriptions.The analysis is conducted using a moderately eclectic methodological approach. Thus, we first employ some descriptive analysis and model simulations with a standard backward-looking macroeconometric model to obtain some preliminary empirical evidence on what type of developments seem to cause inflation and how the economyreacts to the relevantshocks.We then make use of a micro-founded two-country two-sector-model to understand better the structural characteristics of the economy that seem more closely associated with persistently positive inflation differentials.Thatmodel, taken from a companion

paper (see López-Salido etal., 2004)incorporates, as a distinctive feature with respect to other models in this tradition, aricherspecification of the wage formation process including both nominal wage rigidities and inflation indexation in order to better cope with some relevant aspects of the Spanish economy. Moreover, we assume that a fraction of economic agents have no access to the financial markets.

The rest of the paper is organised as follows. Section 2 provides some stylised facts on euro area inflation differentials, the potentially relevant features of the Spanish economy that characterise its price developments and the likely adjustment mechanisms that may have taken place. Building on that evidence, Section 3 presents a general equilibrium model and conducts simulations and sensitivity analysis to show the relevance of key structural parameters and fundamental shocks to explain the recent Spanish inflationary process. Finally, Section 4offers some tentative policy conclusions.

2 Some facts and preliminary evidence

2.1 Inflation differentials in EMU

In ECB (2003) it is possible to find a comprehensive description of inflation differentials in EMU. The standard deviation of national inflation rates have fluctuated at around 1% over the last few years. This is in line with the dispersion of inflation rates among the 14 US Metropolitan Statistical Areas but significantly above that corresponding to German, Spanish or even US Census regions. In addition, unlike in other long-established currency unions, inflation differentials in EMU show a remarkable persistence. Several countries, like Ireland, Greece, Portugal, Spain and, until last year, the Netherlands have experienced annual inflation rates which have frequently exceeded the EMU average by more than 1 p.p.. Bycontrast, Austria and Germany, the largest euro area country, have systematically experienced a negative price growth differential with the EMU average which has often implied differences of inflation with other member countries of more than 2 p.p.

A first factor that might help explain persistent inflation differentials in EMU is the Balassa-Samuelson effect. This hypothesis

requires national inflation rates to be positively correlatedwiththe difference between labour productivity growth in the tradable sector and that in the non-tradable sector. Chart 2.1 explores this correlation by representing for all 12 EMU countries both average inflation and the average productivity growth differential between tradable goods (approximated bymanufacturing) andnon-tradable goods (approximated by market services). The chart shows an apparent positive correlation which is, however, totally explained by data corresponding to Germany and Ireland. In Germany, low productivity growth in the manufacturing sector has helped reduce aggregate wage and price inflation. The opposite is true in Ireland, where the productivity boom in tradables has generated wage and price inflation. In the remaining cases there is no clear association between inflation and productivity developments. In particular, in the rest of the high-inflation countries (Spain, Portugal, Ireland and the Netherlands), sectoral productivity growth differentials have been below the EMUaverage.

A second factor is price convergence.This may be caused by factors suchas tax harmonisation, income convergence or trade liberalisation. The econometric evidence provided by Rogers (2002), with individual price data, and by Honohan and Lane (2003), with different aggregate price measures, shows however that price convergence is unlikely to explain much of the cross-country variation of inflation within the euro area, evenafter 1999.

A third explanation for persistent inflation differentials relies on the different cyclical positions of euro area countries which, possibly in combination with some nominal or real rigidities, could generate diverging price developments. Chart 2.2 depicts the variation of the output gap in each country over the period 1999-2003, together with average inflation. Here the existence of the expected positive correlation is clearer. Indeed, changes in the cyclical position may helpexplain the average inflation differential in Greece and Spain, though not in the Netherlands and Portugal.

A fourth explanation for persistent differentials could be the different exposure to oil prices and the exchange rate of the euro economies in an environment in whichthose variables have fluctuated widely. Indeed, the importance of extra euro-area trade in the Netherlands and Ireland, the depreciation of the euro in the first few years after the introduction of the euro andits subsequent appreciation mayhelp partially explain the relatively high differential in these

countries until 2003 and the fall observed thereafter. More generally, Hanohan and Lane (2003, 2004) provide evidence on a negative correlation between the effective exchange rate and national inflation figures in the euro area.

Therefore, the above evidence points to different factors being relevant for different countries. This phenomenon can be further illustrated by providing a simple inflation accounting exercise for the five high-inflation countries, as presented in Table 2.1.[1] In the table it is clear that domestic costs are more relevant than import costs for explaining the increase of the final demand deflator in Greece, Spain and Portugal, and, to a lesser extent, in Ireland, but not in the Netherlands. Moreover, while all five countries experienced high wage growth, its impact on inflation was significantly offset by high productivity growth in Greece and Ireland. Finally, profit markups made an important cotribution to the GDP deflator differential in Greece, Spain and Ireland, but not in the Netherlands and Portugal. Thus, we can conclude that it is difficult to find a single explanation for persistent inflation divergence in EMU.

2.2 Some selected features ofthe Spanisheconomyaffecting price developments

Having documented the diverse anatomyof inflation differentials in EMU, it would be worth concentrating on some aspect of the Spanish economy that might help identify the determinants and implications of the specific price developments in Spain. The following features probably merit being highlighted in that regard:

1. **Relatively high and stable growth based completely on domestic demand.**
   Chart 2.3 presents GDP in Spain and in the euro area since 1999 and the contributions of domestic demand and net exports. As can be seen, growth rates in Spain over the period were significantly higher than those of the euro zone. This was due to the strong expansion of domestic demand as the contribution ofnet exports has been persistently negative. In particular, domestic private consumption, especially services, and

1. This is an update of some of the information contained in Table 3 of ECB (2003).

construction investment grew at rates well above that for overall GDP.[2] Those components benefited very directly from the marked reduction in nominal and real interest rates associated with the process of nominal convergence and EMU membership, and strong employment creation.

2. Low productivity growth

Chart 2.4 depicts labour productivity and total factor productivity (TFP) in Spain and the euro area.Labour productivity growth has decreased in Spain bymore than in the euro area since 1990. The labour market reforms implemented in the course of the nineties in connection with the increase in labour supply contributed to a marked decrease in the capital/labour ratio[3]. Moreover, as shown in the chart, TFP growthhas also decreased substantially in the last ten years, remaining below the euro area average in the whole EMU period. Productivity performed poorly in both manufacturing and market services, although in 2003 the industrial sector saw a rise in productivity, linked largely to extensive job destruction.

3. Significant deviations from purchasing power parity and dual inflation

Table 2.2 presents an inflation accounting exercise for Spain somewhatmore detailed than the that presented in Table 2.1. The inflation differential is now decomposed into the contribution oftradables andthatofrelative inflation between tradables and nontradables (as in Estrada et al. 2004).[4] The exercise shows that inflation in tradables has made a sizeable contribution to the average inflation differential -measured in terms of the GDP deflator-since 1999. However, dual inflation between non-tradables and tradables account for about one-third of the total average differential. High growth in margins after 1999 -which are particularly noticeable in the non-trada-

2. According to the available break-down ofconsumption in the Spanish National Accounts, average growth rate of consumption of services was 4,1 p.p., i.e. 1 p.p. higher than that of food or manufactured goods. Moreover from 1999 to 2003 the average growth rate of housing investments was around 6 p.p.

3. The averate rate of growth of the Spanish participation rate during the period 99-03 was 1.4 p.p., almost 1 p.p. above the average growth rate in the nineties.

4. See also the Table 2.2. for a detailed description on how this decomposition has been constructed.

ble sectorexplains a large part of both the total inflation differential and the dual inflation component[5]. Wage developments also make a significant contribution to overall price growth, although they do not seem to differ much across sectors. As expected from the above discussion, productivity growth does notexert a significant influence on the observed inflation differential.

4. Persistent losses in competitiveness but moderate impact on trade

As can be seen in Chart 2.5, persistent inflation differentials have been associated with losses in competitiveness vis-à-vis the euro zone that range between 5% and 8% depending on the index used. Chart 2.6 depicts the export shares of Spanish products in the euro area since 1991. In this chart we also present data on the penetration of imports from the euro area in total domestic demand. Export shares and import penetration have been increasing steadily over the periodas a consequenceof Spain's economic development and progressively greater integration into the European economy, although both have decelerated in recent years.It is therefore difficult to identify any significant impact of the relatively high growth of prices and costs on the trade balance. Notwithstanding, it cannot be ruled out that the adverse course of competitiveness might contribute to explaining the more pronounced deceleration in export shares than in import penetration.

5. Structural rigidities: more relevant in the labour market

We lacka sufficiently comprehensive comparative analysis of the functioning of goods and labour markets in different EMU countries. Still,the degree of competition and price flexibility in the product markets does not generally seem higher in Spain than in other euro-area countries (see Nicoletti et al., 1999). Moreover, some recently available microeconomic evidence on nominal price adjustments indicate that there is little idiosyncrasy in the pattern of price changes by Spanish retailers. Thus, Álvarez and Hernando (2004) find that the frequency of price changes (between six months and one year) and the pro-

5. Those are obtained as a residual, given observations on compensation per employee and productivity.

portion of downward corrections (around 40%) is remarkably close to the estimates available for other euro-area countries. In the labour market, there is notmuchevidence either pointing toparticularly highnominal wage rigidity in Spain. However, there are some indications on specific wage rigidities in Spain associated, generally, with the prevailingwage-bargaining mechanisms. In particular, a system of backward price indexation (*cláusulas de salvaguardia*), which is currently present in around 80% of collective bargaining agreements, may contribute to generating inflation inertia. This type of indexation clause is not present in the standard labour contracts prevailing in most euro area countries[6]. This is therefore an idiosyncratic feature whose relevance will be explored in the simulation exercises performed in Section 3.

2.3 How does the Spanish economy react to inflationary shocks?

The above descriptive analysis already provides some hints on the likely causes of the persistent Spanish inflation differential. As a complement to that evidence and to start exploring the macroeconomic consequences of diverging price developments, it is useful to conduct some simulation analysis based on an estimated macroeconometric model. This will allow us to obtain some preliminary evidence on the effects of purely idiosyncratic shocks in a small open economy set up. In the next section we will perform similar exercises, but using a microfounded general equilibrium two-sector two-countrymodel-where we can also analyze the effects of common shocks (see below for details).

The model we employ here is the Quarterly Model of the Spanish Economy of the Banco de España described in Estrada etal. (2004). This is a relatively standard purely backward lookingsmall open economymodel with a single production sector, estimated througherror correction-like specifications.

The first exercise we perform is an exogenous positive aggregate demandshockcalibrated to produce a 1% impact effect on GDP. The shock is assumed to follow an AR(1) process with a persistence parameter of .9. In Chart 2.7 we present impulse-response functions for

6. According to the European Commission (2003), automatic wage indexation is only present in the majority of contracts in Belgium, Luxembourg and Spain. In the Netherlands, Greece, Finland and Italy, indexation clauses are occasionally included in some sectors. finally, in Germany, France, Ireland and portugal, there does not seem to be any explicit indexation mechanism.

several variables of interest: GDP, HICP, domestic demand, consumption, contributions of net exports to GDP, terms of trade and exports.

The immediate effect of the shock is a direct increase in GDP that boosts consumption and investment. Deviation of prices from the baseline grows steadily up to thirteen quarters after the shock. Only then does it start to decrease slowly. That effect reduces real interest rates for at least two years. This, together withthe laggedeffects of the shockon expenditure, generates an expansion of domestic demand that exceeds the impact effect for two years before starting to converge to the baseline. The inflation differential only vanishes after five years. Net exports contribute to moderating GDP and, therefore, prices, but this is mainly due to import growth associated with larger final demand. The economy undergoes a 6According to the European Commission (2003), automatic wage indexation is onlypresent in the majority of contracts in Belgium, Luxembourg and Spain. In the Netherlands, Greece, Finland and Italy, indexation clauses are occasionally included in some sectors. Finally, in Germany, France, Ireland and Portugal, there does not seem to be any explicit indexation mechanism. moderate butextremely persistent loss in competitiveness that affects exports very gradually.

A second exercise we perform is a persistent decline in the nominal interest rate -an exogenous variable in this model-with a maximum effect on GDP of 1%. As can be seen in Chart 2.8, the impulse response functions are similar to those derived for the aggregate demand shock. The only noticeable difference is that the effects on output and prices are somewhat more persistent and peak later than with the aggregate demand shock. This is merely the consequence of lagged effects of interest rates on consumption and investment.

These exercises provide valuable insights as they seem to reproduce quite well some phenomena recently experienced bythe Spanish economy. In particular, they suggest that the economy's recent expansion has been largely driven by the nature of the original expansionary shock -which is probably more persistent than that assumed in the exercises. But there have also been some relevant reinforcing effects associated with the reduction in real interest rates caused by higher inflation, as this has contributed to expanding further private expenditure. It also interesting to see that the terms of trade effect does not play a strong stabilising role as has been suggested sometimes in the literature (see e.g. Blanchard, 2001). Nevertheless, the

deterioration in competitiveness has a very long-lasting impact on export performance.

In any case, the simulations performed provide only stylised facts of the adjustment process of the economy to different shocks. In particular, it does not allow us to identify the frictions in the functioning of the economy that could explain the path followed by different variables, particularly prices. As above noticed, in this small open-economy onesector setting we cannot investigate the effects of common shocks to the euro area and those of specific sectoral shocks. We explore these issues in the next section.

3. A GENERAL EQUILIBRIUM ANALYSIS

This section presents some simulation exercises in a newly developed-macroeconomic model with a twofold purpose. First, we characterise the combination of shocks and frictions that may generate an inflation differential similar to that observed for Spain. Second, we illustrate the adjustment that, in the presence of the most likely shocks, would have taken place between domestic and foreign demand, both for nominal andreal variables.Unlike with a standard macroeconometric model, a structural microfounded approachpermits us to focus on the most recent period, i.e. that of Spain within the euro area.

Specifically, we consider a two-region currency area in which the monetary authority sets nominal interest rates to safeguard price stability in the area as a whole. In the steady state inflation is equal accross regions/countries, however over the business cycles there is domestic inflation variabilityand hence the real interest rate can be thoughtofas a countryspecific variable. As we will consider a two-sector economy with tradable and non-tradable goods, we will be able to analyse the phenomenom of dual inflation (i.e. the rate of change in the relative price of non-tradable to tradable goods), and obtain more accurate measures of trade competitiviness.[7]

The model incorporates a number ofnominal andreal frictions that are now standard in the literature to matchdata persistence (see, for example, Christiano, EIchenbaum and Evans (CEE, 2004) for

7. Duarte and Wolman (2002) and Altisimo et al. (2004) also consider a two-sector economy to analyse inflation differentials in the euro area. Yet none of these authors look quantitatively at the relative importance of the dual inflation phenomena

the US and Smets and Wouters (SW, 2003) for the euro area) although, for simplification, we do not incorporate capital accumulation.More specifically, the model displays price and wage rigidities. Among the latter we assume that there is a different degree ofwage indexation in the two countries, as was suggested in the previous section.

On the real side, we allow for non-perfect substitutability between tradable and nontradable consumption goods, as well as between foreign and domestically produced tradable goods. We also introduce external habits in consumption to generate a persistent humpshaped response of output.Finally, inspired bythe evidence presented in section 2, a fraction of consumers (spenders or rule of thumbers) are assumed to have no access to financial markets to smooth consumption over time (as recently emphasised by Gali et al. (2003)). As predicted bymost large-scale macromodels (including the *Quarterly Model of the Banco de España*), and by the recent VAR literature, there seems to be a crowding-in effect of government spendingshocks (or anyother autonomous expenditure shock) on private consumption. This effect cannot be reproduced in pure neoclassical set-ups, where consumption is crowded out byexogenous demand shocks.Asimple wayto avoidthis counterfactual crowding-out effect is to assume that not all consumers are able to smooth cosumption over time.

3.1 Model description and calibration

The Appendix presents a relatively detailed description of the model employed. In this section we simply outline the structure of the economy, agents' objectives and some relevant equilibrium conditions.

The two countries(or regions), domestic(H)and foreign(F), are symmetric andshare the same currency. Each country is specialised in the production of a continuum of varieties of tradable (Y_T)and non-tradable goods (Y_N). Labour (L)is the only production factor and each specific factor can be moved across sectors but not across regions.

Households provide labour and consume all varieties of domestic goods (C_T and C_N) as well as foreign tradable goods (C_F). The baskets for total consumption (C)and tradable goods (C_T) are assumed to follow a CES form, where the parameters γ and $\phi \in [0,1]$ represent the share of traded goods in total consumption and the

share of home-produced goods in total traded goods, respectively. Households are wage-setters in the labour market, and wages are set using a Calvo-type contract. A given fraction of these households $(1-\lambda)$ have access to capitalmarkets and in particular to a riskless bond that pays a gross nominal interest rate R_t at any state of the world. The other fraction of households (λ)do not have access to the capital markets and do not save, i.e. they consume their disposable incomeresulting from working a certain amount of hours. At the prevailing wage firms allocate their labour demand uniformlyacross the two type of households.

Firms are monopolistically competitive producing differentiated intermediate goods. Each production function presents decreasing returns to labour. These intermediate goods are used as an input by a (perfectly competitive) firm producingasingle final good in each sector. Intermediate firms set prices in a staggered fashion also following a Calvo contract.

Monetary policy sets the nominal interest rate each period following a simple Taylor rule that gives a lower weight to the Spanish economy relative to the rest of the area. This is the simplestway to modelthe differentrelevance of the two economies in the determination of the area-wide monetary stance.We now describe some equilibrium conditions thataim to capture the key demand and supply ingredients of the model, so helping to understand the determinants of inflation differentials and the macroeconomic adjustment in the domestic economy.

Demand equilibrium conditions[8] A log linear approximation around the steady state of the consumption Euler equation of the non-restricted or optimisers consumers (c_t^o) yields

$$c_t^o = \omega c_{t-1}^o + (1-\omega)E_t c_{t+1}^o - \frac{1}{\sigma}(r_t - E_t\pi_{t+1})$$

where $\omega = \frac{\eta}{1+\eta}$ and $0 \leq \eta < 1$ is the external habits parameter. In particular, this is a standard equibrium relationship where consumption is a function of the real interest rate, but given the habit formation assumption, it also depends on a weighted average of past and future consumption. Hence, the previous expression can be

8. Here we focus on some equilibrium conditions where the variables are expressed in log deviations from their steady state.

solved for consumption as a function of past consumption and the long run real interest rates, i.e.

$$c_t^o = \eta\ c_{t-1}^o - \frac{1+\eta}{\sigma}\sum_{k=0}^{\infty} E_t\{r_{t+k} - E_t\pi_{t+k+1}\}$$

The external habits parameter, η, can be thought of as an indicator of the degree of consumption (demand) persistence in response to long-run real interest rates. In addition, the existence of complete markets implies that the marginal utilities of consumption between non-restricted consumers in the domestic andthe foreign economy (c_t^*) are equal,[9]

$$\sigma(c_t^o - c_t^*) - \eta(c_{t-1}^o - c_{t-1}^*) = \{p_t^* - p_t\}$$

where, under the assumption of log utility and no habits, the previous expression links relative prices to relative consumptions for non-restricted households across the area.

In the domestic economy, the allocation of the total consumption will also depend upon the dynamics of disposable income, and hence on real wages and labour. This is so because the rule of thumb consumers (C^r) will equate consumption to their (net) labour income (see Galí, et al. (2003).) Formally,

$$c_t^r = (w_t - p_t) - \chi l_t$$

Aggregate consumption becomes a convex combination of both types of consumption, i.e.

$$c_t = \lambda c_t^r + (1-\lambda)c_t^\circ$$

The allocation of consumption accross home produced, non-traded, and imported depends upon the evolution ofrelative prices according to the elasticities of substitution among consumption goods as well as the shares (i.e. γ and ϕ) -see Appendix for details.-

We now turn to the dynamics of net exports. A linear approximation to net exports yields

$$nx_t = -(1-\phi)\gamma(\zeta - 1)\ tt_t + (1-\phi)\gamma(c_{T,t}^* - c_{T,t})$$

where ζ represents the elasticity of substitution between tradable domestic and imported goods. Net exports will depend upon the behavior of the terms of trade, (i.e. $tt_t \equiv p_{H,t} - p_{F,t}$) as well as the

9. We are assuming that preferences are equal in both countries of the area.

relative demands of tradable goods. Notice that an increase in the terms of trade, i.e. an increase in the relative prices of domestic goods to imported goods is aimed at capturing loss in competitiveness, and hence it will lead to a direct reduction in net exports.

Supply equilibrium conditions The dynamics of prices and wagesin eachcountry are determined by the corresponding optimal decisions of firms and households. The sectoral price equations are a function of expected future price markups, and lag inflation (given indexation of price contracts); and the sectoral wage equations are a function of expected future wage markups and lag inflation (given indexation of wage contracts.) Formally, if we concentrate on the domestic economy we have

$$\{\pi_{J,t} - \delta_p \pi_{t-1}\} = \beta E_t\{\pi_{J,t+1} - \delta_p \pi_t\} - \lambda_{p,J}\ \mu^p_{J,t}$$

$$\{\pi^w_{J,t} - \delta_w \pi_{t-1}\} = \beta E_t\{\pi^w_{J,t+1} - \delta_w \pi_t\} - \lambda_{w,J}\ \mu^w_{J,t}$$

for $J = T, N$, respectively, and where π_J, π^w_J represent the rate of growth of sectoral prices and nominal wages, respectively. Finally, as noticed above, the driving forces of both prices and wages are the sectoral price markups ($\mu^p_{J,t}$) defined as the difference between sectoral labour productivity and real wages, and the wage markup ($\mu^w_{J,t}$) defined as the difference between the sectoral real wage and the household marginal rate of substitution.[10] The influence of these variables on prices and wages is determined by the slope coefficients ($\lambda_{p,J}$ and $\lambda_{w,J}$,, respectively), which depend on the average duration of the contracts, the elasticity of the goods and labour demand curves, the extent to which there are decreasing returns to labour over the business cycle, and the slope of labour supply. Additionally, the indexation parameters ($\delta's$) indicate the proportion of firms/workers that adjust their prices to past inflation when they can not be adjusted optimally.

Accounting for inflation differentials Given the structure of the model, it is possible to obtain an expression for the inflation differentials between domestic economy and foreign, i.e. $\pi_t - \pi^*_t$. Formally, it can be shown that[11]

$$\pi_t - \pi^*_t = (1-\gamma)(\pi_{N,t} - \pi_{H,t}) - (1-\gamma^*)(\pi^*_{N,t} - \pi_{F,t}) + \varphi \Delta tt_t$$

10. See, for instance, Erceg, et al. (2000) and Galí, et al. (2003).

where φ represents the effects of terms of trade fluctuations on inflation differentials. Formally $\varphi = (\phi - \phi^*) + (1 - \gamma^*)\phi^* + (1 - \gamma)(1 - \phi)$. There are, therefore, three main sources of inflation differentials, the two relative dual inflation terms, i.e. the differences between non-tradable and domestically produced tradable goods in both economies, and changes in the terms of trade. Interestingly, assuming no home bias (i.e. $\phi = \phi^*$) and the same consumption structure across countries (i.e., $\gamma^* = \gamma$)would implythatinflation differentials are merely a function of changes in relative prices of non-tradable goods.

Calibration Table 3.1 describes the calibration that we use as a benchmark. Each period is assumed to be one quarter, so a discount-rate β of 0.99 implies a steady state annual real interest rate of 4%. The utility function is separable and assumed to be logarithmic in both arguments, C and L. Thus, the risk aversion parameter (σ) is1as is also the elasticity of wages with respect to hours (χ). The external habit stock (h)is estimated at 0.7, somewhat higher than that estimated by SW (2003). The proportion of constrained consumers (λ) is 0.5.

The elasticity of substitution between tradable and non-tradable (ρ)is 0.44, thevalue estimated by Stockman and Tesar (1995), and the elasticity of substitution between domestic and foreign traded goods (ξ)is 1.5, as in Backus etal. (1995). The elasticity of substitution betweenlabour across sectors(ν)is set equal to –1, consistent with the perfect mobility case. The share of tradable goods in the consumption basket in the domestic economy (γ) is 0.5 and the proportion of domestic goods in the tradable basket (ϕ)is 0.75. However, the share of domestic goods in the foreign consumption basket of tradable (ϕ^*)is assumed to be only 0.2, in order to represent a smaller penetration of imports from the domestic economy.

In the production function the labour share (α_J)is 0.7, consistent with the average euro area data. The elasticity of substitution across

11. In the model we do not allow for price discrimination between domestically produced goods and exports, since the law of one price applies to both imported (F) and domestically produced tradable goods (H). Therefore, p_H will capture the price of exported goods as well as the price of domestically produced goods consumed inside the country. Symmetrically,p_F will reflect both the price of imported goods for the domestic economy as well as the price of those domestically produced and consumed in the foreign economy.

goods, ϵ_p, is set such that it implies a 10% steady state markup; and the elasticity of substitution across labour goods, ϵ_w, implies a 5% steady state wage markup (as in CEE.) We also abstract from country or sectoral asymmetries in prices and labour mobility, although we assume higher stickiness in the labour market than in the goods market. The fraction of firms that keep their prices unchanged (θ_p) is 0.65, which corresponds to an average price duration of slightly less than three quarters, and the fraction of households that keep their wages unchanged (θ_w)is 0.75 implying an average wage contract duration of one year. There is full indexation in the goods markets (δ_J^p=1) but, as suggested in section 2, we assume that there is asymmetry across countries in the degree of wage indexation(δ_{J*}^w=0.4, δ_J^w=0.8).

We set the policy parameter that measures the response of the interest rates to aggregate inflation, ϕ_π, to 1.5, a value commonly used in the Taylor rules. The weight of domestic (Spanish) inflation on the rule is 0.1.

Therefore, in our benchmark specification we make rather prudent assumptions regarding the degree of heterogeneity across sectors and countries. Thus, we assume the same price and wage behaviour across sectors. Moreover, the two-country economies are modelled in a similar manner except in what is directly influenced by their size - which affects both the consumption baskets and the arguments ofthe monetary policyrule-and the different wage setting behaviour.This conservative approach seemsjustified on the basis of the available evidence for the Spanish economy. We will, however, conduct some sensitivity analysis later on.

3.2 Sources of fluctuations and inflation differentials

We have conducted several simulation exercises corresponding to area-wide, country-specific, or country and sector-specific shocks. Thus we contemplate: i) a common monetary policy shock; ii) an aggregate productivity shock in the domestic economy; iii) a productivity shock to the sector of tradables in the domestic economy, iv) a preference (aggregate consumption) shock in the domestic economy; and v) a shock to the demand for non-tradables in the domestic economy. All shocks follow an AR(1) process with persistence

parameter of 0.9 and a variance calibrated to produce a change in total outputof 1% in each case.

We focus for the time-being on inflation differentials and present in Table 3.2 some statistics expressing the maximum impact of each shock on the inflation differential between the two economies and the accumulated effect over 12 quarters. We also represent the accumulated impact on the inflation differential between domestically produced tradable goods and imports ($\pi_H - \pi_F$) and domestic dual inflation ($\pi_N - \pi_H$).

Starting with the common monetary policy shock, the simulation performed shows that there is essentially no effect on inflation differentials.The asymmetry assumed in the wage setting mechanism andthe degree ofopenness is therefore not sufficient to generate aggregate price dispersion between the two economies. This shock does however create significantly more inflation in the tradable sector than in the non-tradable sector (a negative dual inflation effect). This is due to the spill-over effects associated with the foreign demand increase in domestically-produced tradable goods in both economies.

The (positive) productivity shocks in the domestic economyare notable either to generate positive inflation differentials in the domestic economy. Not surprisingly, an aggregate positive supplyshock does notonly increase output but also reduces the price level (which translates into negative persistent inflation as a consequence of price and wage rigidities) in both sectors. Probably more interesting is the case ofa productivity shock in the domestic tradable sector. Consistent with the Balassa-Samuelson hypothesis, this shock generates substantial dual inflation as nominal wages increasein both sectors -there is perfect labour mobility across sectors and wage indexation to the aggregate inflation rate-but productivity only increases in one of them. However, domestic traded goods become much less expensive than foreign goods due to the sectoral technological improvements. Under our calibration ($\phi > \phi^*$) this terms of trade effect is slightly more important than the dual inflation effect, thereby generating a small negative inflation differential. This result has been previously obtained by Benigno and Thoenissen (2003).

As for country-specific demand shocks, both an aggregate consumption (preference) shock and a shock to non-tradables demand generate positive inflation differentials as expected. The differential is larger and more persistent in the case of the preference shock. The

reason is that in this forward looking model only the corresponding part of the exogenous demand shock in non-tradables will crowd out consumption of non-rationed agents, thereby reducing aggregate demand and requiring a smaller price adjustment to return to equilibrium.[12]

While the non-tradable demand shock generates a significant dual inflation effect, this is not present in the case of an aggregate consumption shock. Therefore, in this model, in which price and wage setting are similar across sectors, dual inflation can only be generated bya demandshock if this is biased towards non-tradable goods.

3.3 Sensitivity analysis

In order to check the robustness of the results to some changes in the parameters ofthe model, we perform simulations with alternative calibrations. In particular, we are interested in analysing the sensitivity of the results to a higher degree of country and sector heterogeneity. We focus on the price indexation parameters to past inflation (parameters δ^p's) since, in principle, the assumption made on the similarity of the price-setting rules across sectors and countries may be considered particularly strong. More over, we concentrate on the three demand shocks, as the productivity shocks seem unable to generate both output expansion and positive inflation differential in the domestic economy as has been observed in Spain. In Table 3.3, we present simulation results corresponding to two different modifications of the benchmark model: i)price indexation is dropped in the foreign country; ii) price indexation is dropped in both the foreign economy and the domestic tradable sector.

As can be seen in Table 3.3, consideringno price indexation in the foreign economyand full price indexation in the domestic one does not qualitatively change much the effects of both demand shocks in the domestic economy: namely, inflation differentials are positive for both country specific shocks and the dual inflation effect is only present if the demand shock is specific to non-traded goods. However, this asymmetry introduces a relevant source of cross-country heterogeneity into the transmission of monetary policy impulses. Unlike with the benchmark calibration, a common monetary policy shock

12. This effect is obviously not present in the case of a direct consumption shock.

generates in this case a positive inflation differential in the domestic (now more rigid) economy. Nevertheless, this common shock is still having a significantly larger inflationary effect on tradables than on non-tradable goods.

It could be considered, that the monetary policy shock and the domestic aggregate consumption shock could be generate a positive differential between inflation in non-tradables and tradables if we allowed for more sector heterogeneity. Indeed, as shown in the second line of Table 3.3, if price indexation is only limited to the non-tradable sector in the domestic economy, the preference shock now generates a dual inflation effect, albeit of a relatively small size. Similarly, the monetary policy shock now has a more symmetric impact on both domestic sectors although, in this case, inflation is still larger in tradables. Given the extreme assumption made on the asymmetry of the degree of price indexation across sectors, these simulations suggest that the phenomenon of dual inflation can hardly be explained in this setting without sector-specific shocks.

For completeness, we have conducted a third exercise consisting of removing completely price indexation in both economies while maintaining wage indexation, as in the benchmark calibration. The results, which are also presented in Table 3.3 (third line), are qualitatively similar to those corresponding to the benchmark model. The only shock which is able to generate both a positive inflation differential and dual inflationis anincreaseinthe domestic demand for non-tradables, although its effect is, as expected, slightly smaller than in the model that included price indexation. Therefore, the exercise indicates that a relatively high degree of wage indexation in the domestic economy has much power in explaining the persistence of inflation differentials in the domestic economy.

3.4 The adjustment process

The above analysis seems to support the idea that the expansion of the demand for nontradable goods and wage indexation in the labour market are likelyto feature among the key determinants of inflation developments in Spain over the last few years. Still, as seen in Section 2, although clearly larger for non-tradable products, consumption expansion in the Spanish economy has been relatively widespread. We have seen, however, that while a purely aggregate consumption

shock can generate persistent inflation differentials in our model, it does not contribute to dual inflation –a well–establishedcharacteristic ofthe Spanish inflationary process-unless additionalheterogeneityis imposed across sectors.Thus, as a way to increase our ability to reproduce some relevant aspects of Spanish economic developments, we have combined both an aggregate consumption shockand a shock to the demand for nontradables and introduce a relatively higher degree of indexation in the price-setting rule in the non-tradable sector than in tradables. Although it is hard to find strong direct evidence to support that latter assumption, incorporating a lower degree of price flexibility in services than in tradable sectors is relatively common in the literature (see e.g. Costa-Dias and Neves, 2004, Le Bihan and Sevestre 2004 and Altissimo et al., 2004). Moreover, evidence for the Spanish economy (again in line with that for the euro area) shows that the proportion of downward price revisions in services is lowerthan that in food or industrial goods (see Alvarez and Hernando 2004).

It is therefore worth looking at the adjustment paths of a model with the above features subject to a composite demand shock. That exercise can only be, however, a very stylised representation of the experience of the Spanish economy. In particular, the economy has been subject to an idiosyncratic real interest rate shock that cannot be incorporated into our setting since nominal interest rates are common for the euro area and domestic inflation is a purely endogenous variable. In any case, an exercise assuming a (composite) exogenous demand shock may provide a good proxy for the effects of a more realistic lower interest rate scenario, as actually proved to be the case in the simulations conducted in Section 2 with an estimated macroeconometric model.

We have therefore performed a new simulation exercise of a composite shock consisting of two independent shocks: a shock to aggregate consumption (preferences) andan exogenous demand shock to non-tradable goods. As before, both shocks have a persistence parameter of .9 and are calibrated so as to yield an impact effect on GDP of .5% each. In addition, the indexation parameter (δ_p) is set to .5 in the tradable sectorbut remains at 1 in the non-tradable sector. The rest of the parameters are as in the benchmark calibration.

In Chart 3.1 we present the impulse-response functions for some key variables. By construction, the shock generates immediately a 1% expansion of output. Aggregate consumption grows close to that rate

due to the presence of rule-of-thumb consumers that generate a crowding-in effect of the non-tradable demand shock. This adds to the direct impact on optimising-consumers' expenditure of the preference shock. As expected, a country-specific demand shock biased towards non-tradable goods in combination with asymmetric wage and price indexation across sectors generates an inflation differential which is larger and more persistent than in the case of a pure non-tradable demand shock. Moreover, the exercise yields a significant dual inflation phenomenon. The foreign economy experiences a small contraction as a consequence ofthe effect of higher domestic inflation on interest rates through the monetary policy rule. This in turn helps contract exports of the domestic economy and moderate the impact of the shock on the price of domestic tradable goods. Interestingly, as occurred with the simulations performed with the estimated macroeconometric model for the Spanish economy, net exports only decline very moderately and, therefore, does not help stabilise the economy much after the shock. Finally, the impact of the shock on the terms of trade is relatively mild but very persistent, so it implies sustained losses in competitiveness.

4 Conclusions

In this paper we have presented some descriptive evidence and simulation exercises with both an estimated backward looking model and a calibrated general equilibrium forward looking model that allow some light to be shed on the determinants and macroeconomic implications of persistent inflation differentials in Spain. We have shown that an aggregate demand expansion beyondwhatcould be purelyjustified by disposable income growth and biased towards consumption ofnon-tradable goods -such as services and housing-is likely to be the main driving force behind diverging price developments in this country. The relatively high persistence of those demand developments on domestic inflation seems largely due to the inertial components of the price and wage-setting rules of the economy among which some forms of real wage rigidities, such as those caused by wage indexation clauses, seem to play a predominant role. In addition, the size and persistence of inflation differentials in combination with the dual inflation phenomenon seem to suggest that prices in non-tradable sectors could be somewhat more rigid than in

tradables. This feature, more than crosscountry differences in price behaviour, may significantly help amplify the relative inflation effects of the idiosyncratic demand expansion.

Moreover, we have providednew evidence that further supports the idea that Balassa-Samuelson effects have not played any significant role in the recent past. Not only does the Spanish economynot seem to have been subject to anyaggregate or sector-specific positive technology shock, but it would have been unlikely for this to have translated into a positive inflation differential.

Having identified the likely determinants of Spanish inflation differentials we were in a position to investigate their implications for the real economy. We have found that, in general, the deterioration of the terms of trade that inflation differentials cause does not have a quantitatively relevant stabilising effect as its impact on output is relatively small in the short term. It does however depress exports in a moderate but persistent manner as the economy's loss of competitiveness is only absorbed after a long period. This effect is obtained in model simulations that do not incorporate any hysteresis in the response of exports to a real.appreciation.

Therefore, to the extent that the persistent inflation differentials of the Spanish economy are not linked to a structural catching-up process, the self-correction mechanisms are relatively weak, and may generate long-lasting losses in competitiveness, diverging price developments are of policy relevance for domestic authorities.

In the Spanish case, in the absence of an autonomous monetary policy, fiscal policy and, in particular, government consumption seems, in principle, a powerful instrument to contain private demand pressure especially if, as is the case in Spain, this is largely concentrated on non-tradable goods.Moreover, even ifthe Spanisheconomy does notapparently have larger nominal or real rigidities in product markets than other euro-area countries, the macroeconomic impact may be more damaging since, as has been shown, they tend to amplify the adverse effects of country-specific expansionary shocks on competitiveness. But, more importantly, given the key role played by real wage rigidities in generating persistent inflation differentials, the economy will clearly benefitfrom more flexible labour contracts and, particularly, from a less generalised inclusion of wage indexation clauses.

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APPENDIX. THE MODEL

In this appendix, based upon our companion paper (López-Salido, Restoy and Vallés (2004)), we describe the two-country-two sector model. The domestic economy is populated by two types of households, optimisers (or savers) and those that have no access to financial markets (restricted or spenders). Households have monopoly power over the different varieties of labour they can supply, so that they act as wage setters. There are two sectors in the economy: the tradable goods and the non-tradable goods sectors. In each sector there is a continuum of monopolisitically competitive firms that set prices in a staggered fashion. Finally, there is a central bankthat sets the nominal interest rates for the whole area.

HOUSEHOLDS

1. Optimisers

The preferences of a generic intermporal optimiser household h are given by

$$E_0 \sum_{t=0}^{\infty} \beta^t e_t [\frac{1}{1-\sigma} \left(\frac{C_t^o(h)}{H_t} \right)^{1-\sigma} + \frac{\kappa}{1+\chi} L_t^o(h)^{1+\chi}] \quad (2)$$

where C_t^o and L_t^o are a composite of household consumption goods and labour effort, with $\chi \geq 0$, $\sigma \geq 0$, and $0 < \beta < 1$.The variable e_t is a preference shock that will not affect the marginal rate of substitution between consumption and hours.The utility functions depends positively on consumption relative to an external habit variable, H_t, which is assumed to be a function of aggregate past consumption, i.e.

$$H_t = C_{t-1}^{\eta} \quad (3)$$

with $0 \leq \eta < 1$. Notice that under $\eta = 0$ preferences correspond to the standard CRRA case.

Let C_t^o be a CES index that defines household preferences over tradable consumption, $C_{T,t}^o$, and non-tradable consumption, $C_{N,t}^o$:

$$C_t^o = \left[(\gamma)^{\frac{1}{\rho}} \left(C_{T,t}^o \right)^{\frac{\rho-1}{\rho}} + (1-\gamma)^{\frac{1}{\rho}} \left(C_{N,t}^o \right)^{\frac{\rho-1}{\rho}} \right]^{\frac{\rho}{\rho-1}} \quad (4)$$

where $C_{T,t}^o$ is a composite index over tradables produced at home-

domestically consumed, $C_{H,t}$, and tradables made by foreigners, $C^o_{F,t}$

$$C^o_{T,t} = \left[(\phi)^{\frac{1}{\zeta}} \left(C^o_{H,t}\right)^{\frac{\zeta-1}{\zeta}} + (1-\phi)^{\frac{1}{\zeta}} \left(C^o_{F,t}\right)^{\frac{\zeta-1}{\zeta}}\right]^{\frac{\zeta}{\zeta-1}} \quad (5)$$

The parameters γ and $\phi \in [0,1]$ represent the share of traded goods in total consumption and the share of home-produced goods in total traded goods, respectively. The parameters $\rho > 1$ and $\zeta > 1$ represent the elasticity of substitution between goods.

Each country produces a continuum of varieties of the tradable goods, indexed by $i \in [0,T]$, and a continuum of non-traded goods indexed by $j \in [T,1]$. In this economy, $C_{H,t}$ and $C_{N,t}$, and $C_{F,t}$ are aggregates of the continuum of varieties. These varieties are imperfect substitutes with elasticity of substitution $\varepsilon_J > 1$, for $J = H, N, F$. Formally ,we have it that

$C_{H,t} \equiv \left(\int_0^T C_{H,t}(i)^{\frac{\varepsilon_H-1}{\varepsilon_H}}\, di\right)^{\frac{\varepsilon_H}{\varepsilon_H-1}}$, $C_{N,t} \equiv \left(\int_T^1 C_{N,t}(j)^{\frac{\varepsilon_N-1}{\varepsilon_N}}\, dj\right)^{\frac{\varepsilon_N}{\varepsilon_N-1}}$ and $C_{F,t} \equiv \left(\int_0^{T^*} C_{F,t}(i)^{\frac{\varepsilon_F-1}{\varepsilon_F}}\, di\right)^{\frac{\varepsilon_F}{\varepsilon_F-1}}$ for tradable home-produced, non-tradables, and imported consumption goods, respectively.[13]

From the previous assumptions it follows that the price indexes definedas the minimun expenditure necessary by one unit of the corresponding composite good leads to

$$P_t = \left[(\gamma)\left(P_{T,t}\right)^{1-\rho} + (1-\gamma)\left(P_{N,t}\right)^{1-\rho}\right]^{\frac{1}{1-\rho}} \quad (6)$$

and

$$P_{T,t} = \left[(\phi)\left(P_{H,t}\right)^{1-\zeta} + (1-\phi)\left(P_{F,t}\right)^{1-\zeta}\right]^{\frac{1}{1-\zeta}} \quad (7)$$

where P_t is the consumption-based price index; $P_{T,t}$ and $P_{N,t}$ are the aggregate price indexes of tradable and non-tradable composite consumption goods. Finally, $P_{H,t}$ and $P_{F,t}$ are the price indexes of tradable domestically consumed goods and imported tradable goods. Formally, these price indexes are

$P_{H,t} = \left(\int_0^T P_{H,t}(i)^{1-\varepsilon_H}\, di\right)^{\frac{1}{1-\varepsilon_H}}$, $P_{N,t} = \left(\int_T^1 P_{N,t}(j)^{1-\varepsilon_N}\, dj\right)^{\frac{1}{1-\varepsilon_N}}$, and $P_{F,t} = \left(\int_0^{T^*} P_{F,t}(i)^{1-\varepsilon_F}\, di\right)^{\frac{1}{1-\varepsilon_F}}$ for home-produced, non-tradable, and imported consumption goods, respectively. The optimal allocation of any given expenditure within each category of goods

13. Given the symmetry between optimiser $'o'$ and rule-of-thumb consumers $'r'$ in the intratemporal optimal allocation of consumption and hours worked we have eliminated the superscript $'o'$ in this section.

yields the following demand functions: $C_{H,t}(i) = \left(\frac{P_{H,t}(i)}{P_{H,t}}\right)^{-\varepsilon_H} C_{H,t}$, $C_{N,t}(i) = \left(\frac{P_{N,t}(i)}{P_{N,t}}\right)^{-\varepsilon_N} C_{N,t}$, and $C_{F,t}(i) = \left(\frac{P_{F,t}(i)}{P_{F,t}}\right)^{-\varepsilon_F} C_{F,t}$.

Finally, the optimal allocation of expenditures between non-traded and traded goods as well as between traded home-produced and imported goods imply:

$$C_{T,t} = \gamma \left(\frac{P_{T,t}}{P_t}\right)^{-\rho} C_t \tag{8}$$

$$C_{N,t} = (1-\gamma) \left(\frac{P_{N,t}}{P_t}\right)^{-\rho} C_t \tag{9}$$

$$C_{H,t} = \phi \left(\frac{P_{H,t}}{P_{T,t}}\right)^{-\zeta} C_{T,t} \tag{10}$$

$$C_{F,t} = (1-\phi) \left(\frac{P_{F,t}}{P_{T,t}}\right)^{-\zeta} C_{T,t}. \tag{11}$$

Each firm uses a specific labour factor and each household can supply all varieties of labour in the country to produce traded and non-traded goods. To capture frictions in labour mobility, we also assume that labour effort might not be perfectly substitutable across sectors. In particular, $L_t(h)$ is a CES composite of $L_{N,t}(h)$ and $L_{T,t}(h)$, as follows:

$$L_t(h) = \left[(\psi)^{1+v} \ (L_{T,t}(h))^{-v} + (1-\psi)^{1+v} \ (L_{N,t}(h))^{-v}\right]^{-\frac{1}{v}} \tag{12}$$

with $\psi \in [0,1]$ is the fraction of labour effortthatwill be employed in thetradablesector, and $(1+v)^{-1} > 0$ captures the degree of substitution between the two varieties of labour. When $v = -1$ the elasticity of substitution between labour efforts is infinite, hence it is very easy to switch from one labour into another, while the value $v = 0$ corresponds to a Cobb-Douglas specification. These intra-temporal labour adjustment costs are meant to capture the idea that the reallocation of labour from one sector to the other is costly for the household. In particular, as $v \leq -1$ gets smaller, it becomes increasingly difficult to reallocate labour from one sector to the other.[14]
In this economy, $L_{T,t}(h)$ and $L_{N,t}(h)$ are a composite index of a

14. This case corresponds to a "reverseCES" labourallocation.That is, it generates labourindifference curves concave to the origin and a utility function convex in labour.

continuum of imperfectly substituted varieties of labour with elasticity of substitution $\varepsilon_w > 1$, $L_{T,t}(j) \equiv \left(\int_0^1 l_{T,t}(i)^{\frac{\varepsilon_w - 1}{\varepsilon_w}} \, di\right)^{\frac{\varepsilon_w}{\varepsilon_w - 1}}$ and $L_{N,t}(j) \equiv \left(\int_0^1 l_{N,t}(i)^{\frac{\varepsilon_w - 1}{\varepsilon_w}} \, di\right)^{\frac{\varepsilon_w}{\varepsilon_w - 1}}$. The optimal allocation of labour within each category yields the following labour demand functions for each variety of labour supplied to a generic firm in both sectors:

$$l_{T,t}(i) = \psi \left(\frac{W_{T,t}(i)}{W_{T,t}}\right)^{-\varepsilon_w} \left(\frac{W_{T,t}(h)}{W_t(h)}\right)^{-\frac{1}{1+v}} L_t(h)$$

$$l_{N,t}(i) = (1-\psi) \left(\frac{W_{N,t}(i)}{W_{N,t}}\right)^{-\varepsilon_w} \left(\frac{W_{N,t}(h)}{W_t(h)}\right)^{-\frac{1}{1+v}} L_t(h) \ ,$$

where the wage indexes take the form:

$$W_{T,t}(h) = \left(\int_0^1 W_{T,t}(i)^{1-\varepsilon_w} \, di\right)^{\frac{1}{1-\varepsilon_w}}$$

$$W_{N,t}(h) = \left(\int_0^1 W_{N,t}(i)^{1-\varepsilon_N^w} \, di\right)^{\frac{1}{1-\varepsilon_w}}$$

for domestically produced tradable goods and non-traded goods, respectively. Finally, the aggregate wage index, W_t ,is given by

$$W_t(h) = \left[(\psi)\left(W_{T,t}(h)\right)^{\frac{v}{1+v}} + (1-\psi)\left(W_{N,t}(h)\right)^{\frac{v}{1+v}}\right]^{\frac{1+v}{v}} \quad (13)$$

Eachnon-restricted household faces the following budget constraint:

$$P_t C_t^{\circ}(h) + \frac{B_{t+1}(h)}{R_t} = B_t + W_{J,t}(h) L_{J,t}(h) + \Pi_t + T_t \quad (14)$$

At the begining of the periodhe/she receives labour income, $W_{J,t} L_{J,t}$, where $W_{J,t}$ denotes the sectoral nominal wage, and $L_{J,t}$ the amount of hours devoted to work at sector J. The non-restricted households have access to an international riskless bond, B_{t+1}. R_t is the gross interest rate of the bond held at the end of period t. Finally, the households receive the dividend from the firms, Π_t , and lump-sump transfers, T_t.

Under these assumptions, the household maximisation of (2) subject to (14) leads to the following optimality conditions for consumption/saving and labour supply:

$$\frac{W_{T,t}(h)}{P_t} = \kappa \frac{L_t^{\chi}(h)}{\lambda_t} \left(\frac{\psi L_t(h)}{L_{T,t}(h)}\right)^{1+v} \quad (15)$$

$$\frac{W_{N,t}(h)}{P_t} = \kappa \frac{L_t^{\chi}(h)}{\lambda_t} \left(\frac{\psi L_t(h)}{L_{N,t}(h)} \right)^{1+v} \tag{16}$$

$$\lambda_t \; e_t = \beta E_t \{ \lambda_{t+1} e_{t+1} R_t \}, \tag{17}$$

where λ_t is the marginal utility of the consumption index C_t°(i.e. the Lagrange multiplier of the budget constraint) and is given by:

$$P_t \; \lambda_t \; = \left(\frac{C_t^{\circ}}{C_{t-1}^{h\circ}} \right)^{-\sigma} \tag{18}$$

Sticky wages

As in Erceg, Henderson andLevin (2000), eachperiodonlya fraction $1-\theta_w^J$ of households workingat sector J reset their nominal wage. Let $\widetilde{W}_{J,t}$ denote the sector $J's$ newly set wage at time t, in nominal terms. Until the next reoptimisation, that wage is adjusted automatically each period according to the indexation rule:

$$\widetilde{W}_{Jt,t+k} = \widetilde{W}_{Jt,t+k-1} \; \eta_{J,t+k}^{w}$$

for $j = 1, 2$,..,where $\eta_{J,t+k}^{w}$ is the wage indexation rate which we assume to be a functionof last period country inflation. By forward iteration we obtain:

$$\widetilde{W}_{J,t,t+k} = \widetilde{W}_{J,t} \prod_{s=1}^{k} \eta_{J,t+k}^{w} = X_{J,tk}^{w} \; \widetilde{W}_{J,t} \tag{19}$$

where $X_{J,tk}^{w} = (\prod_{s=1}^{k} \eta_{J,t+k}^{w})$.

The wage setting problem consists Pof choosing the wage $\widetilde{W}_{J,t}$ that maximises the expected discounted stream of utility, $E_0 \sum_{t=0}^{\infty} \beta^t \; U$ $(C_t^{\circ}, L_t(h))$, subject to a sequence of period budget constraints (14), and the labour demand

$$L_{J,t+j}(h) = \left(\frac{\widetilde{W}_{J,t}}{W_{J,t+k}(h)} \right)^{-\varepsilon_w} L_{J,t+k} \tag{20}$$

Hence, when optimising, households will set the nominalwage $\widetilde{W}_{J,t}$ according to:

$$E_t \sum_{k=0}^{\infty} (\beta \theta_w^J)^k \; L_{J,t+k}(h) \lambda_{t,t+k} \left(\frac{\widetilde{W}_{J,t} X_{J,tk}}{P_{t+k}} + \frac{\varepsilon_w}{\varepsilon_w - 1} \; MRS_{J,t,t+k}(j) \right) = 0 \,, \tag{21}$$

where $MRS_{J,t,t+k}(h) = -\frac{U_{L_{J,t+k}}}{\lambda_{t,t+k}}$. It is straightforward to see that, under flexible wages, i.e. $\theta_w^J \to 0$, then the previous expression yields the following (standard) static labour supply schedule. The law

of motion for the aggregate wage index is given by:

$$W_{J,t} = \left[\theta_w^J \left(\eta_{J,t}^w W_{J,t-1}\right)^{1-\varepsilon_w^J} + (1-\theta_w^J)\left(\widetilde{W}_t^J\right)^{1-\varepsilon_w^J}\right]^{\frac{1}{1-\varepsilon_w^J}} \quad (22)$$

2. RULE-OF-THUMB HOUSEHOLDS

Rule-of-thumb households do not borrow or save, possibly because of lack of access to financial markets or (continuously) binding borrowing constraints. As a result, they cannot smooth their consumption path in the face of fluctuations in labour income or intertemporally substitute in response to changes in interest rates. Their period utility is the same as the ricardian consumers, and the only difference in their budget constreint is that these consumers have no access to financial markets and do not pay taxes, hence they face a static and simple budget constraint:

$$P_t C_t^r = W_t L_t^r \quad (23)$$

As was the case for optimising households, hours L_t^r are determined by firms' labour t demand, and are thus not chosen optimally by each household given the wage. Accordingly, the level of consumption will equate labour income, i.e.

$$C_t^r = \frac{W_t}{P_t} L_t^r \quad (24)$$

Finally, given the wage, each firm decides how much labour to hire, and allocates its labour demand uniformly across households, irrespective of their type. Accordingly, we have $L_t^r = L_t = L_t^{TOTAL}$ for all t.

Firms

We assume the existence of a continuum of monopolistically competitive firms producing differentiated intermediate goods inside each sector. Each intermediate firm in the traded goods sectors produces a variety, $y_t^T(j)$, that can be sold at home or in the Union as a consumption good:

$$Y_{T,t}(j) = C_{H,t}(j) + C_{H,t}^*(j) \quad (25)$$

where $C_{H,t}$ represents the domestic demand of domestically produced traded consumption goods and $C_{H,t}^*$ represents the foreign demand of domestically produced consumption, i.e. it represents the

country exports. Each intermediate firm in the non-traded goods sector produces a variety, $Y_{N,t}(j)$, that can be sold at home as a consumption good:

$$Y_{N,t}(j) = C_{N,t}(j) + C_{N,t} \tag{26}$$

where $C_{N,t}$ represents the domestic demand of domestically produced non-traded consumption goods and $C_{N,t}$ is an exogenous autonomous demand of shock affecting only the nontradable sector. In both sectors, the production function is given by

$$Y_{J,t}(j) = A_{J,t} L_{J,t}^{1-\alpha_J}(j) \tag{27}$$

where $A_{J,t}$ is a labour augmenting total factor productivity and $1-\alpha_J$ is the elasticity of value added with respect to labour, for $J = T, N$, respectively.

In both sectors, each firm j will use a specific labour, $L_{J,t}(j)$. These firms choose the amount of labour in perfectly competitive factor markets. Hence, it chooses the amount of labour $L_{J,t}(j)$ to minimise total costs, $mc_{J,t}(j)Y_{J,t}(j)$, where $mc_{J,t}(j)$ is the real marginal cost. Notice that, given cost minimisation, the firms of each sector will take the marginal costs as given when choosing output price. Formally, it follows that the demand for labour in the non-traded goods sector

$$mc_{N,t}(j)\frac{\partial Y_{N,t}(j)}{\partial L_{N,t}(j)} = \frac{W_{N,t}}{P_{N,t}(j)} \tag{28}$$

as well as

$$mc_{T,t}(j)\frac{\partial Y_{T,t}(j)}{\partial L_{T,t}(j)} = \frac{W_{T,t}}{P_{H,t}(j)} \tag{29}$$

Price setting

We will not allow *for price discrimination between domestically consumed and exported tradable goods*, i.e. $P_H = P_H^*$. Hence, each firm j in the tradable sector is able to set the same price[15]

$$P_{H,t}(j) = \left(\frac{\varepsilon_H}{\varepsilon - 1}\right) mc_{T,t}(j) \tag{30}$$

Finally, each firm j in the non-tradabale sector sets prices as follows:

$$1 = \left(\frac{\varepsilon_N}{\varepsilon_N - 1}\right) mc_{N,t}(j) \tag{31}$$

15. Notice that the markup is defined as the inverse of the *real* marginal cost (e.g. Rotemberg and Woodford (1999))

We now discuss the importance ofprice stickiness to model changes in observed markups.

Sticky prices

Intermediate firms are assumed to set nominal prices in a staggered fashion, accordingto the stochastic time dependent rule proposed by Calvo (1983). Each firm resets its price with probability $1-\theta_p^J$ each period, irrespective of the time elapsed since the last adjustment.

Indexation. Consider a firm of sector J which lastset its price $\widetilde{P}_{J,t}$ at time t.The price accruing to that firm at time $t+j$ (before the next reoptimisation) is given by $\widetilde{P}_{t,t+j}$ which satisfies the following general indexation rule:

$$\widetilde{P}_{J,t,t+j} = \widetilde{P}_{J,t,t+j-1}\eta^p_{J,t+j}$$

for $j = 1, 2$,..,where η^p_{t+j} is the price adjustment rate (indexation clause) which we assume to be a function of variables observed at time $t+j$. By forward iteration we obtain:

$$\widetilde{P}_{J,t,t+j} = \widetilde{P}_{J,t}\prod_{k=1}^{j}\eta^p_{J,t+k} = X^p_{J,tk}\ \widetilde{P}_{J,t}\ ,$$

where we define $X^p_{J,tk} = \prod_{s=1}^{k}\eta_{J,t+k}$.

The previous specification allows us to distinguish between partial or full indexation on past country-specific (aggregate) inflation (i.e. $(\eta_{J,t} = \frac{P_{t-1}}{P_{t-2}})$).

Optimal price In general, a firm resetting its price in period t will seek to maximise[16]

$$\max_{\{\widetilde{P}_t^J\}}\ E_t\sum_{k=0}^{\infty}\left(\theta_p^J\right)^k\ E_t\left\{\Lambda_{t,t+k}\ Y_{J,t+k}(j)\ \left(X_{tk}(1+\tau_{J,p})\widetilde{P}_{J,t} - P_{J,t+k}\ MC_{J,t+k}\right)\right\}$$

subject to the sequence of demand constraints, $Y_{J,t+k}(j) = \left(\frac{X_{tk}\widetilde{P}_{J,t}}{P_{J,t+k}}\right)^{-\varepsilon_J} Y_{J,t+k}$ where $\widetilde{P}_{J,t}$ represents the price chosen byfirms resetting prices at time t,and $(1+\tau_{J,p})$ is a sector-specific, subsidy factor. The first order conditions for this problem are:

16. The stochastic discount factor, $\Lambda_{t.t+k}$, is the ratio of the marginal rate of an additional monetary unit $t+k$ periods ahead relative to the marginal utility on an additional monetary unit today. This is treated as exogenous by the firms, and as we will show later is related to the marginal utility of consumption, $\Lambda_{t,t+k} = \beta^k\frac{U_{C_{t+k}}}{U_{C_t}}$.

$$\sum_{k=0}^{\infty} \left(\theta_p^J\right)^k \; E_t \left\{ \Lambda_{t,t+k} \; Y_{J,t+k}(j) \; \left(X_{tk}(1+\tau_{J,p})\widetilde{P}_{J,t} - \frac{\varepsilon_J}{\varepsilon_J - 1} \; P_{J,t+k} \; MC_{J,t+k} \right) \right\} = 0 \quad (32)$$

Finally, the equation describing the dynamics for the aggregate price level is given by

$$P_{J,t} = \left[\theta_p^J \; \left(\eta_{J,t} P_{J,t-1}\right)^{1-\varepsilon_J} + (1-\theta_p^J) \; \left(\widetilde{P}_{J,t}\right)^{1-\varepsilon_J} \right]^{\frac{1}{1-\varepsilon_J}} \quad (33)$$

Aggregation

In a symmetric equilibrium all firms will set the same price inside each sector. In addition, we define aggregate output as follows

$$Y_t = Y_{T,t} + Y_{N,t} \quad (34)$$

Aggregate consumption and hours are given by a weighted average of the corresponding variables for each consumer type. Formally:

$$C_t^{TOTAL} \equiv \lambda \; C_t^r + (1-\lambda) \; C_t^o \quad (35)$$

$$L_t^{TOTAL} \equiv \lambda L_t^r + (1-\lambda) L_t^o \quad (36)$$

In addition, the GDP deflator can be obtained as follows

$$P_t^Y = \frac{P_{H,t} Y_{T,t} + P_{N,t} Y_{N,t}}{Y_t} \quad (37)$$

Finally, the nominal exports

$$P_t NX_t = P_{H,t} C_{H,t}^* - P_{F,t} C_{F,t} \quad (38)$$

Monetary policy

The central bank sets the nominal interest rate so as to respond to deviations ofoutput, inflation andmoney growth from their steady-state values accordingto the expression:

$$\ln(R_t/R) = \rho_\pi \{ n \ln(\pi_t) + (1-n) \ln(\pi_t^*) \} + \varepsilon_{r_t} \quad (39)$$

where ε_{r_t} represents a monetary policy shock.

Table 2.1.
Inflation accounting of selected countries (1999-2003)

	Final demand deflator (Contributions to change)			GDP deflator (Contributions to change)				
	Total (%)	Domestic	Imports	Total (%)	Wages	Productivity	Markups	Taxes
EMU	1.85	1.50	0.36	2.03	1.42	-0.31	0.69	0.23
Deviations from EMU average								
GR	1.48	1.16	0.32	1.45	2.69	-1.96	0.25	0.48
ES	1.33	1.26	0.07	1.78	0.89	-0.12	0.71	0.31
IE	1.16	0.63	0.53	2.08	2.06	-1.80	1.52	0.29
NL	0.10	-0.09	0.19	1.40	1.11	0.16	-0.20	0.33
PT	0.58	0.62	-0.04	1.66	1.61	0.13	-0.55	0.47

Table 2.2.
Spanish inflation differentials: 1999-2003 ($\pi_t - \pi_t^*$)

Inflation differential	Tradables				Dual inflation			
	Total	Wages	Product.	Markups	Total	Wages	Product.	Markups
(1)+(2)	(1)	(a)	(b)	(c)	(2)	(a)	(b)	(c)
1.2	0.8	0.4	-0.1	0.3	0.4	0.1	0.4	0.7

Note: The inflation differential between Spain and the Euro zone can be written as follows:

$$\pi_t - \pi_t^* = TRADABLE_t + DUAL_t$$

where $TRADABLE_t$ represents the differences in the inflation of tradable goods, that can be decomposed as de sum of the differencesin wages (w), markups (μ)minus relative productivities (x):

$$TRADABLE_t = (\pi_{T,t} - \pi_{T,t}^*) = (\Delta\mu_{T,t} - \Delta\mu_{T,t}^*) + (\Delta w_{T,t} - \Delta w_{T,t}^*) - (\Delta x_{T,t} - \Delta x_{T,t}^*)$$

while $DUAL_t$ represent the contribution of the differences between dual inflations, that can also be decomposed as follows

$$\begin{aligned} DUAL_t &= (1-\alpha)\theta[(\Delta w_{N,t} - \Delta w_{T,t}) - (\Delta w_{N,t}^* - \Delta w_{T,t}^*)] \\ &\quad -(1-\alpha)\theta[(\Delta x_{N,t} - \Delta x_{T,t}) - (\Delta x_{N,t}^* - \Delta x_{T,t}^*)] \\ &\quad +(1-\alpha)\theta[(\Delta\mu_{N,t} - \Delta\mu_{T,t}) - (\Delta\mu_{N,t}^* - \Delta\mu_{T,t}^*)] \end{aligned}$$

plus an additional and negligible term that will capture fluctuations in the terms of trade, where α represents the share of imported goods in total consumption and θ is the share of private consumption of no tradables to the total private consumption minus imported consumption. See Estrada et al. (2004) for details. Finally, all the numbers represent average annualrate of growth in percentage points. Accordingto the previous expressions, it is straightfroward to see that the columns (1) and (2) have been obtained as (a)-(b)+(c).

Table 3.1.
Parameter Values

β	Discount factor	0.99
χ	Inverse of labour supply elasticity	1
σ	Intertemporal elast. of substitution	1
η	Consumption habits	0.7
ϕ	Share of of C_H on C_T	0.5
ρ	Elast. of subst. between C_T and C_N	0.44
ξ	Elast. of subst. between C_H and C_F	1.5
v	Elast. of subst. between L_T and L_N	-1
$\gamma = \psi$	Share of of C_T on C or Share of of L_T on L	0.5
ϕ	Share of of C_H on C_T	0.75
ϕ^*	Share of of C_H^* on C_T^*	
α_N	Output elasticity to hours in sector N	0.7
α_T	Output elasticity to hours in sector T	0.7
ϵ_p	Elast.of subst. across goods within the sector	11
ϵ_w	Elast.of subst. across labour within the sector	21
θ_p^N	Prob. of not resetting price at t in sector N	0.65
θ_p^T	Prob. of not resetting price at t in sector T	0.65
θ_w^N	Prob. of not resettingwages at t in sector N	0.75
θ_w^T	Prob. of not resetting price at t in sector T	0.75
$\delta_T^w = \delta_N^w$	Sectoral price index. to own country inflation	1.0
$\delta_F^p = \delta_{N*}^p$	Sectoral price index. to own country inflation	1.0
$\delta_T^w = \delta_N^w$	Sectoral wage indexation to own country inflation	0.8
$\delta_{T*}^w = \delta_{N*}^w$	Sectoral wage indexation to own country inflation	0.4
ϕ_π	Inflation weight in the monetary policy rule	1.5
n	Weight of domestic inflation in the rule	0.1
ρ_r	Autocorrelation monetary policy shock	0.9
ρ_a	Autocorrelation of technology shocks	0.9
ρ_e	Autocorrelation of preferences shocks	0.9
ρ_N	Autocorrelation of non-tradable demand	0.9

Table 3.2.
Inflation Differentials

Source of Fluctuations	Maximum Inflation Diff.		Accumulated at 3 years InflationDifferentials		
	Horizon	Value	$\{\pi_H\text{-}\pi_F\}$	$\{\pi_N\text{-}\pi_H\}$	$\{\pi\text{-}\pi^*\}$
Area-Wide M. Policy	2	0.004	0.002	-1.270	0.080
Home Country Shocks					
Aggregate Tech	2	-0.630	-0.510	-1.330	-1.24
Sectoral Tech	2	-0.150	-1.690	2.240	-0.32
Agg. Cons/Preference	2	0.270	0.420	-0.370	1.10
Sectoral Consumption	2	0.140	0.101	0.44	0.52
Non-Tradable Goods					

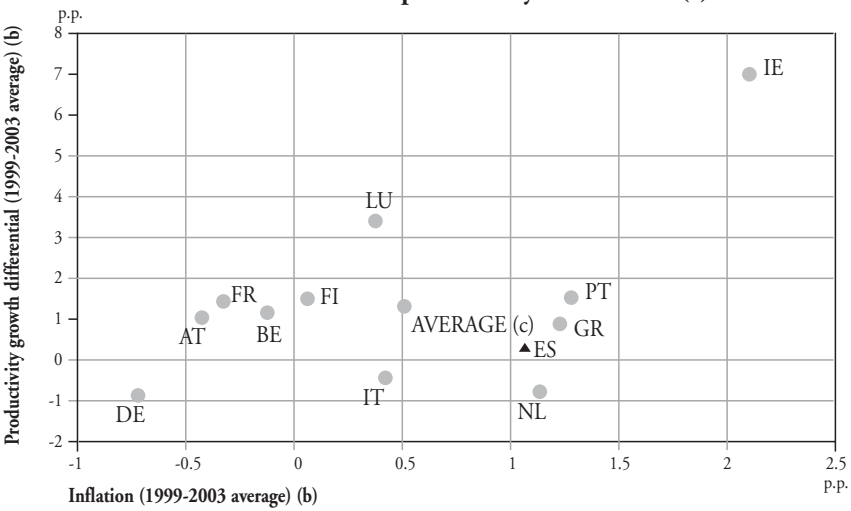
Note: All shocks have been normalised so as to generate a 1% impact effecton output.

Table 3.3.
Sensitivity Analysis

	Monetary Policy			Preferences			Demand for Non-Tradables		
	$\{\pi_H\text{-}\pi_F\}$	$\{\pi_N\text{-}\pi_H\}$	$\{\pi\text{-}\pi^*\}$	$\{\pi_H\text{-}\pi_F\}$	$\{\pi_N\text{-}\pi_H\}$	$\{\pi\text{-}\pi^*\}$	$\{\pi_H\text{-}\pi_F\}$	$\{\pi_N\text{-}\pi_H\}$	$\{\pi\text{-}\pi^*\}$
1	0.18	-1.32	0.61	1.00	-0.37	1.35	0.27	0.44	0.60
2	0.01	-0.43	0.54	0.45	0.26	1.28	0.09	0.60	0.54
3	0.14	-1.27	0.29	0.54	-0.33	1.11	0.12	0.42	0.46

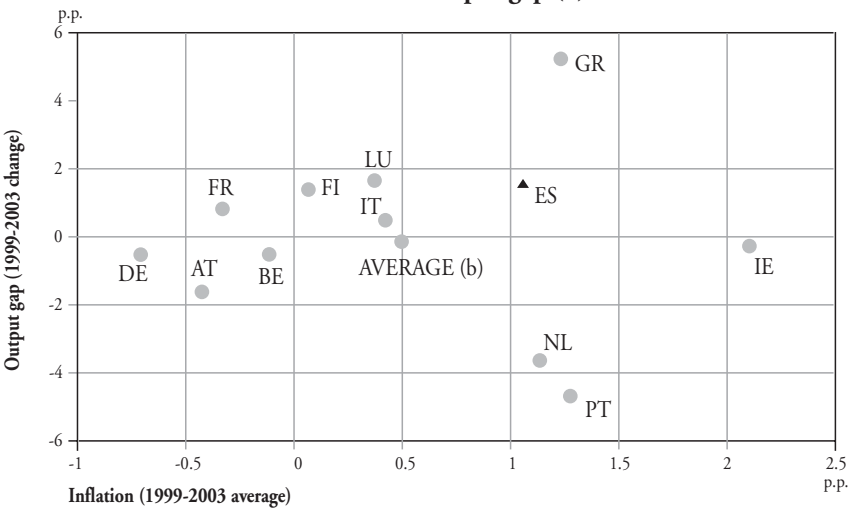
Note: Case 1: No price indexation in the foreign economy. Case 2: Case 1 plus price indexation in the domestic economy only in non-tradable goods sector. Case 3: No price indexation at home and abroad. Simulations based upon the model with rule-of-thumb consumers.

Chart 2.1:
Inflation and sectorial productivity differentials (a)



a. Productivity growth differential between the manufacturing sector and the market services sector.
b. Differential with respect to EMU.
c. Simple arithmetic average of the twelve countries data.

Chart 2.2:
Inflation and output gap (b)



a. Differentials with respect to EMU.
b. Simple arithmetic average of the twelve countries data.

Sources: Eurostat and OECD.

Chart 2.3:
GDP Growth composition

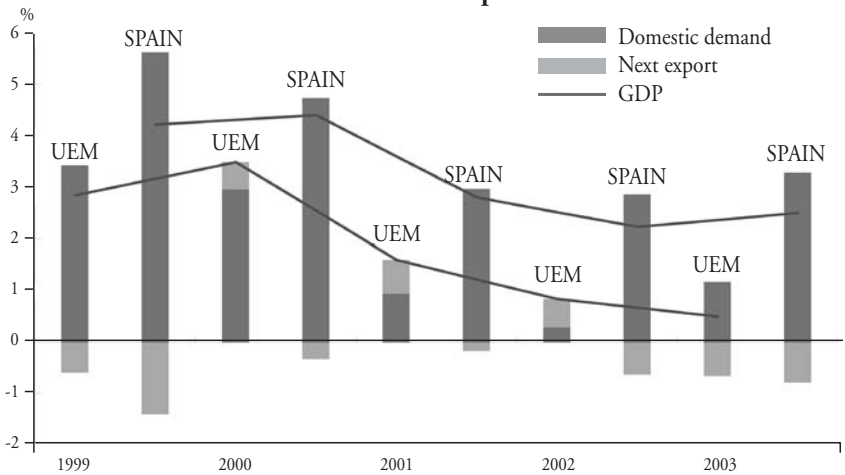
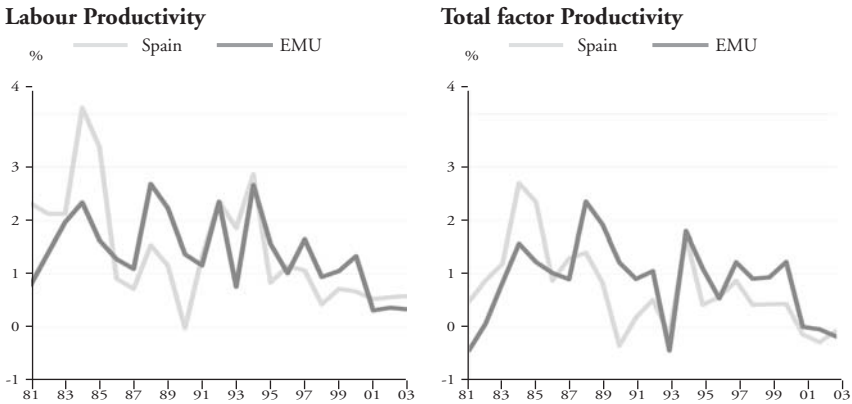
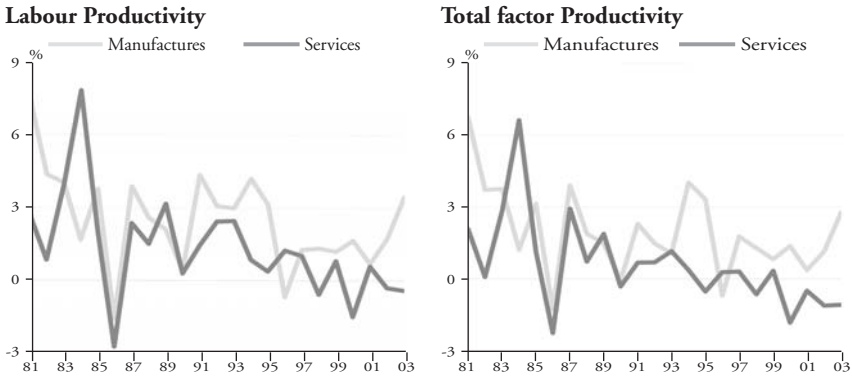


Chart 2.4:
Productivity Growth

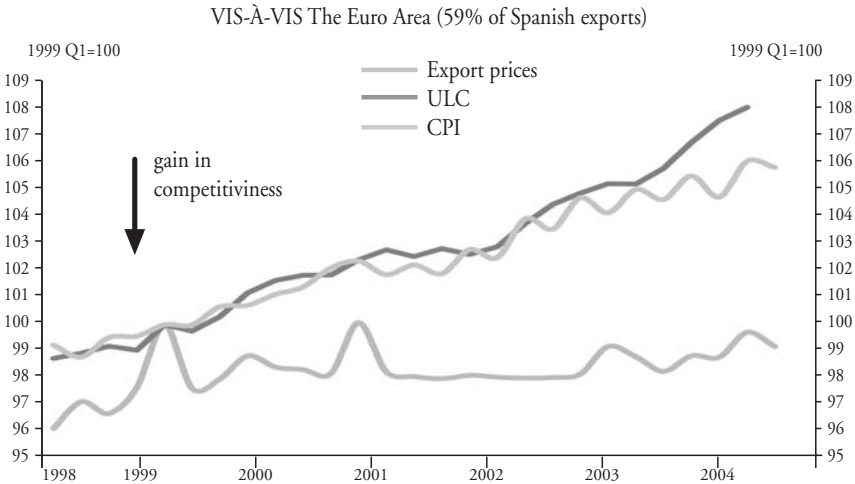


Sectorial Evidence for Spain



Sources: European Comission and Banco de España.

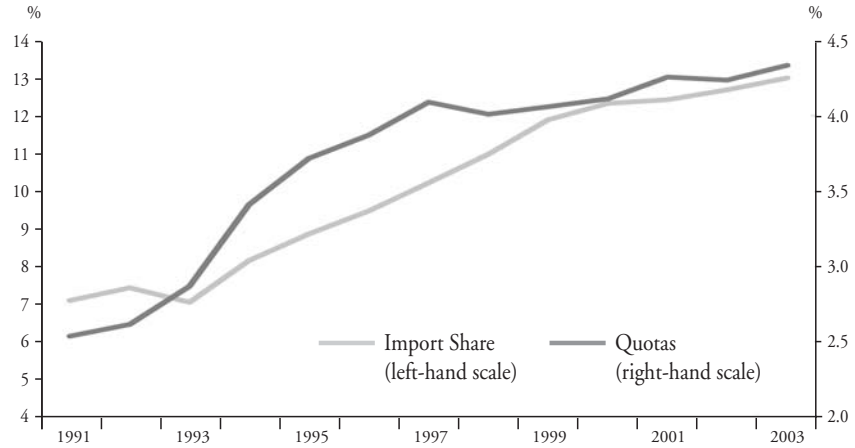
Chart 2.5:
Spanish Competitiviness: relative consumer prices, export prices and unit labour costs (a)



(a) An increase in the index denotes a loss competitiviness, a decrease a gain.

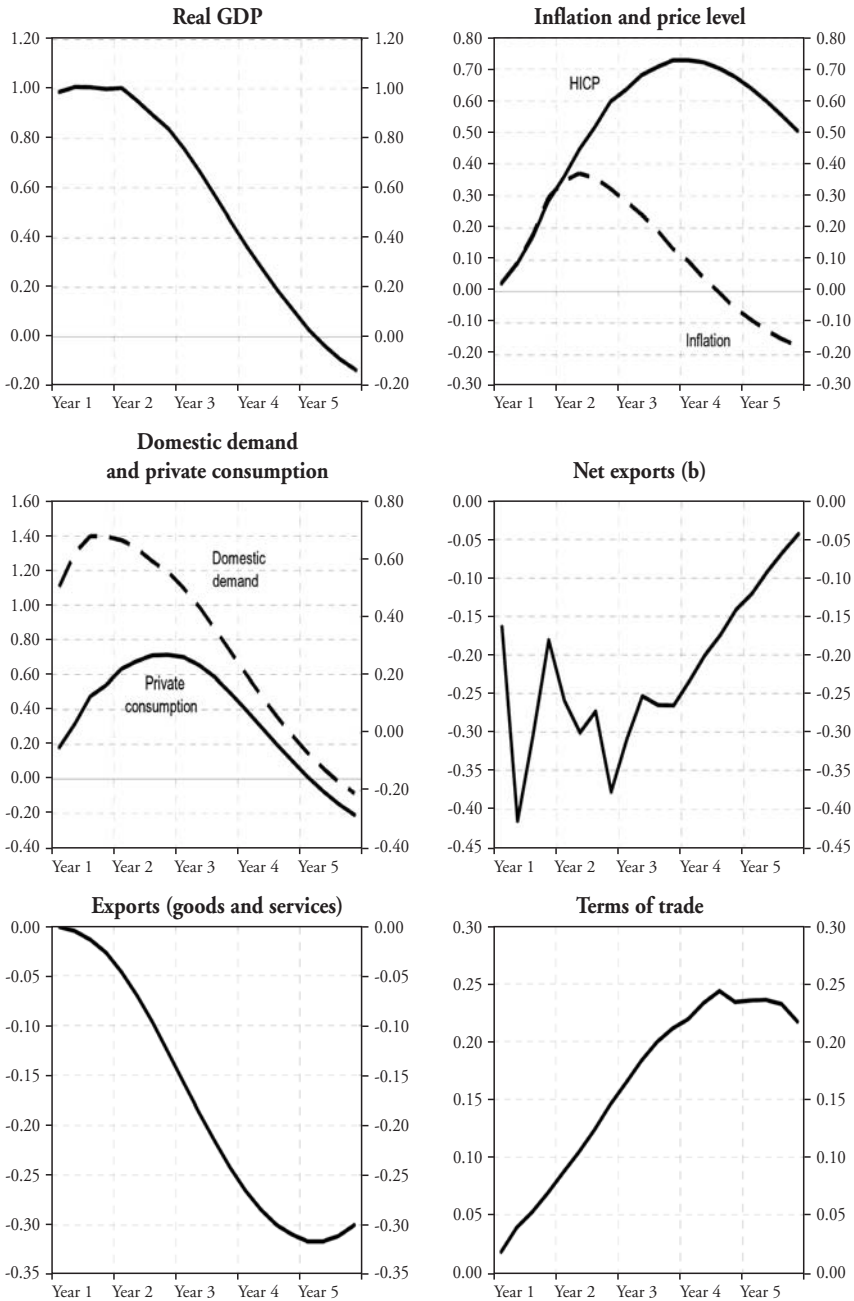
Source: Bank of Spain.

Chart 2.6:
Real export quotas in the EA and real import share in final demand



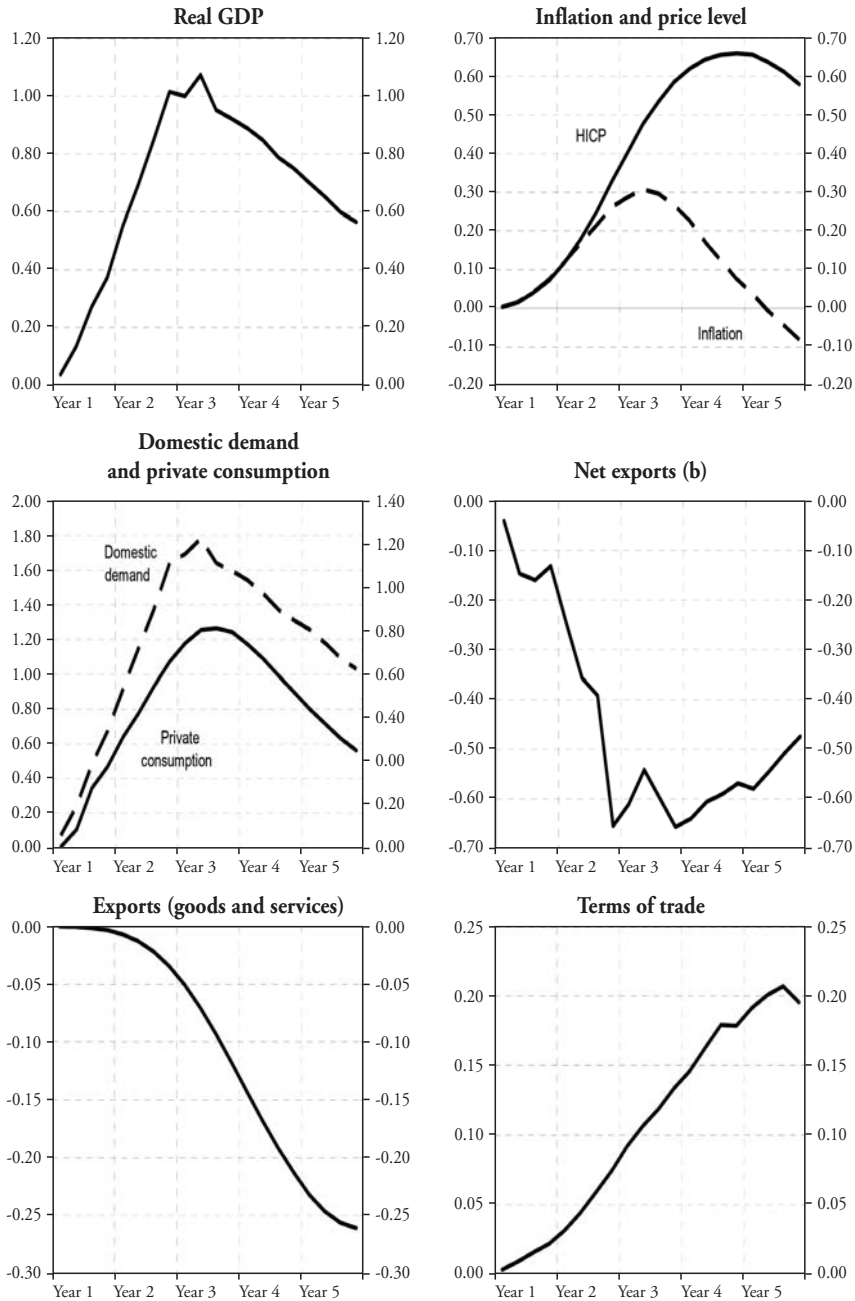
Sources: National Bureau of Statistics and Customs, Spanish Treasury, and IMF.

Chart 2.7:
Governmet expenditure shock (a)
Percentage changes from baseline levels



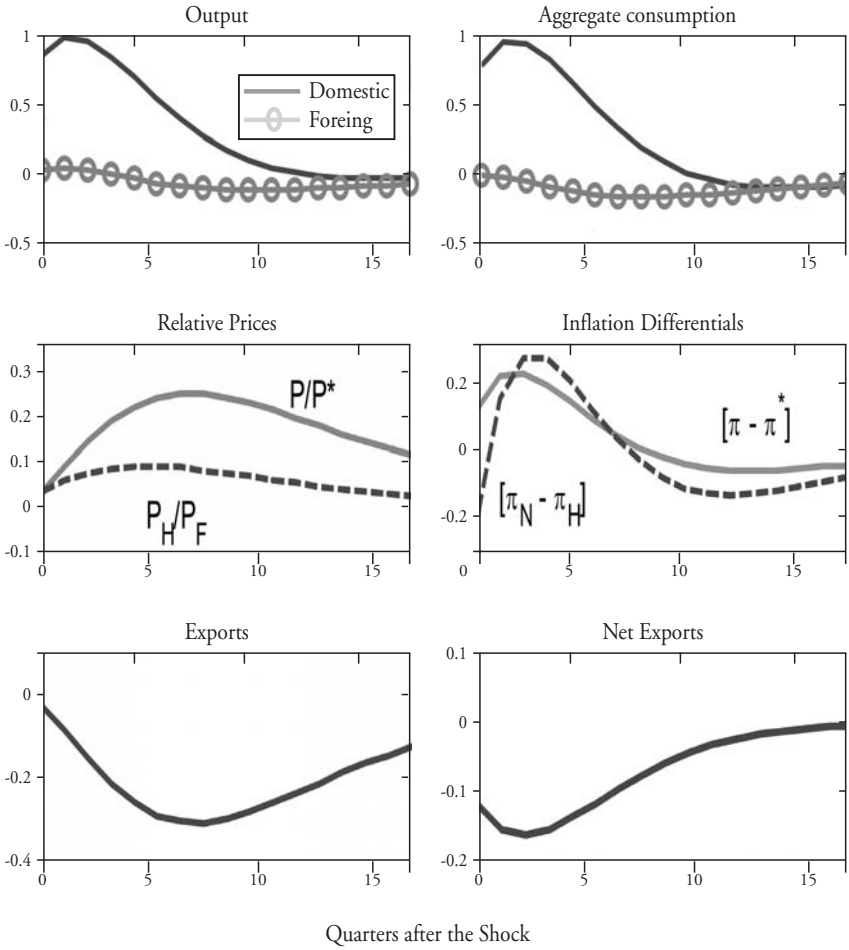
(a) Simulations obtained from the Auarterly Macroeconometric Model of BE.
(b) Contributions to GDP growth.

Chart 2.8:
A monetary policy shock (a)
Percentage changes from baseline levels



(a) Simulations obtained from the Auarterly Macroeconometric Model of BE.
(b) Contributions to GDP growth.

Chart 3.1:
Dynamic responses to a composite demand shock in domestic economy



Comments

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Inflation differential within the eurozone has became a central issue in both academic and policy discussions since a high degree of dispersion in national inflation rates makes the conduct of the common monetary policy more difficult. In this context, it is important to understand whether the inflation differentials are due to an equilibrium phenomenon, such as the change in relative prices associated with the catching-up process, (the Balassa-Samuelson effect, BS), or whether there are also factors at play which may be harmful over the medium-term.

As an introduction to the subject, the authors summarize several potential sources of inflation differentials in a monetary union, such as the BS effect; price convergence caused by factors like tax harmonization, trade liberalization, or income convergence; different cyclical positions; different exposure to oil and exchange rates; and administered price hikes. They conclude that it is difficult to find a single, common explanation for persistent inflation divergence in the euro area. Therefore, country specific causes need to be investigated.

The paper analyses the inflation differential in Spain within the eurozone. It first presents stylized facts and then performs simulations with two models: an estimated macroeconomic model and a calibrated SDGE model. The main conclusions of the paper are that (1) demand expansion in the non-tradable sector, such as services and

housing, combined with wage indexation are among the key determinants of inflation differential in Spain; and (2) the deterioration of the terms of trade that the inflation differential provokes does not have a quantitatively significant stabilizing effect on the real economy and may therefore generate long-lasting losses of competitiveness.

The main merit of the paper is that it uses a variety of tools and a neat, theoretically well founded structural decomposition of inflation. However, the results can be criticized on several grounds. First, for proving the important role of demand and therefore discounting the possible role of BS effect the two models used lack the key elements of the BS mechanism: in the macroeconomic model there are no sectors and in the SDGE model there is no capital. Hence, the results are biased towards strong positive demand effect and weaker negative productivity effect because of two reasons: (1) due to the assumed imperfect substitutability in traded goods (i.e., the law of one price does not necessarily hold), a traded productivity shock depreciates the traded real exchange rate, the effect of which –under the model parametrization- is stronger than the increase in the nontraded-traded inflation gap; and (2) due to lack of capital in the production function, the productivity effect on the nontraded/traded inflation differential is downplayed.

The question is whether it is reasonable to assume a model where productivity gives a negative inflation differential contrary to the BS effect. To use a model closer to the real world, one could insert capital into the production function or even relax the assumption of heterogeneous traded goods. While this latter is indeed a standard assumption in SDGE models, it is not evident that this is a reasonable assumption in the case of Spain. Assuming heterogeneous goods with heterogeneous consumer preferences means that PPP does not hold in the long run even for traded goods between Spain and the euro area. Since Spain is a small open economy compared to the euro area, we might expect that PPP holds in the long run. If this is the case, the negative dual inflation effect of a traded TFP shock would turn into positive. The easiest way of ensuring long-run PPP would be an assumption of homogenous traded goods with some short-term rigidities, such as price discrimination.

Another criticism that can be formulated is that the sensitivity analyses are strongly unbalanced. There is no cross-check for the robustness of weak productivity effect, only demand shocks are considered. The authors themselves admit that the negative productivity

effect depends on the parametrization. Similarly, the effect of wage indexation on inflation differential does not seem to be robust because changes in wage indexation parameters are not presented, only changes in price indexation parameters. It would be more reasonable to relax also wage indexation and see to what extent this changes the results. Furthermore, since wage indexation is an institutional framework, it would be advisable to present some stylized facts before plugging the assumption into the model.

A third criticism relates to the result that the stabilizing mechanism of the terms of trade effect is weak. It is unclear from the paper whether this finding is a robust result of the SDGE model, since there is no sensitivity check. Given that Spain's export shares have increased even though the stylized facts show that there has been no productivity growth, the question that comes to mind is whether the composition of exports has not changed. The authors could usefully look at sectoral productivity changes and shifts in the composition of exports to check whether their argument still holds. All the more so, because considering the buoyant export growth, the inflation differential could be due as much to robust external demand as strong domestic demand. That possibility, as well the one that the BS effect has not played a significant role, will have to be convincingly ruled out for the authors to claim that excess domestic demand accompanied by wage indexation is the main cause of the persistent inflation differential in Spain.

DISCUSSION

Antonio Ciccone argues that a better approach to the issue of inflation differentials is one that takes quality improvements into account. These changes in quality induce inflation differentials that might be explained by the Balassa-Samuelson model, but ones that are not reflected in the available measures of the Total Factor Productivity.

Also **Kosuke Aoki** claims that the Balassa-Samuelson model may explain some of the long-run elements of inflation differentials; thus, it would be necessary to decompose the observed differences among the short-run and long-run components.

Jordi Gual says that the model in the paper fails to take into account product market regulations and the evolution of market shares and mark-ups, as important determinants of inflation differentials across European economies. **Juan Francisco Jimeno** agrees on this point and argues that while some of the inflation differentials might have been caused by changes in the (relative) mark-ups, this cannot be explained by a model that incorporates a constant mark-up (constant elasticity of substitution across varieties).

Alex Cuñat suggests that while the model provides an explanation of the observed inflation differential observed in the Spanish economy, a proper check of the robustness of the model would be to try to explain other countries' differentials.

Juan Dolado recalls that the model relies somehow on the traditional critique on the single monetary policy, namely that it fuels inflation differentials by creating disparities in the real interest rate across countries. Nonetheless, this is only part of the story, and the model does not provide an explanation as to why the loss of competitiveness, that the Spanish economy is undergoing, does not contribute to reduce the demand for Spanish produced goods, thus reducing the size of inflation differentials.

Stephen Cecchetti asks why we should care so much about cross-country inflation differentials while we do not care about industry differentials. Along the same lines, **Jaume Ventura** criticizes the lack

of a proper welfare analysis that would tell us whether inflation differentials are 'good' or 'bad'. In fact, in a frictionless economy, price adjustments would be much quicker and inflation differentials would be bigger.

David López-Salido acknowledges that quality improvements may be a part of the story, but this is not consistent with the fact that while prices seemed to have been converging in the run-up to the Euro they have diverged in the latest years. As regards the welfare implications he argues that some inflation differentials may be 'good' while others may be 'bad', depending on the model we have in mind, but it is a fact that the monetary authorities care about them. **György Szapáry** insists on this point arguing that while inflation differentials may be of less relevance in the US, they are a matter of concern in Europe where other self-correcting mechanism are not present. In particular given the lack of factor mobility, inflation differentials may be damaging for competitiveness in some countries.

Javier Vallés replies to some criticisms on the assumptions of the model by saying that what that paper does is to attempt a possible explanation of inflation differentials trough a realistic combination of structural features of the Spanish economy and exogenous shocks. He agrees on that more robustness analysis may be needed to clarify the contribution of the different elements of the model. However, the explanation that some of the participants seem to prefer, namely that Spanish inflation is higher simply because there is more foreign demand for domestic products (a change in preferences in favor of Spanish produced goods), is not consistent with the sharp fall in our exports.

Banking integration in Europe*

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Abstract

The paper studies the evolution and determinants of banking integration across European countries, including New Member States, with attention to the impact that the Euro might have on that process. It is the first time that banking integration is being studied using the data on international consolidated banking assets provided by the BIS. The paper also presents empirical evidence on the determinants of the flow of foreign banking assets across countries of the EU and the Euro area. Banking integration in Europe is still low but it progresses over time. The empirical evidence also shows that integration is affected by both, competitive and institutional conditions so it can not be viewed as a uniform and balanced process across all countries. Finally, evidence is provided indicating that the introduction of the Euro has changed the pace and trend of European banking integration.

1. Introduction

The creation of the Euro is an important step forward towards economic integration and the formation of a single market in Europe. A common currency is expected to have a special impact

* This paper is the sole responsibility of its authors and the views represented here do not necessarily reflect those of the Banco de España. We thank Jaime Caruana and Julio Segura for very helpful and detailed comments. The final version of the paper has also benefited of the comments of S. Cecchetti and G. de la Dehesa, discussants when it was presented at the XVII Moneda y Crédito Symposium, as well as those of an anonymous referee and the Editor, Javier Andrés.
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in the economic integration of European financial markets since it means a common monetary policy and a unique basic interest rate for the whole Euro zone. Instead of a dozen of fragmented national financial markets each with its own currency, the Monetary Union eliminates the national currencies, one of the main sources of fragmentation, and sets up conditions to create a unified financial services market for 12 of the 15 country members, now 25 since last May 10 Central and Eastern European countries were accepted as new members.

But as it is the case with non financial products and services, to remove technical and economic barriers to trade and flows of goods and services across European Union (EU) members does not mean necessarily that trade and cross country flows will actually take place. The creation of a single currency is made precisely with the purpose of increasing the economic benefits of larger markets, in terms of more opportunities for specialization and gains from trade. Several studies present evidence of potential gains of the economic integration, in terms of economic growth for equity and bonds markets, European Commission (2002), and for all financial markets, Guiso et al (2004)[1]. Since these gains are substantial it is of interest to know if financial market integration is actually taking place, both for the whole financial markets and for individual segments, such as the banking sector.

This paper presents empirical evidence of cross country flows of banking assets in the Euro zone in the period 1999-2003, that is, the period when countries have lived with the single currency. The interest of the research is to evaluate the trend in integration of banking activity that can be inferred from the cross country flows and also investigate up to what extent the enlargement of the European Union with New Member States (NMS) can stimulate or slow down the process. Second, the paper responds to the question of whether a single currency has in fact fostered such integration, and, finally, it explores the institutional and economic forces that may enhance or limit cross countries flows of banking assets.

Our research uses data on cross country flows of banking assets published by the Bank of International Settlements (BIS) consolidated international banking statistics which, even though it is the

1. This paper was first published as European Commission Economic Paper, Gianetti et al (2002).

most reliable public data on international banking assets, to our knowledge it has not yet been used for this purpose[2]. The measures of integration documented in the paper are country openness, which we define as the flow of assets from outside that enter into a natio-nal market, and internationalization of national banking systems, which we define as the flow of assets from banks of a given country to the rest of countries. Each of them is aggregated into European measures of openness and internationalization. Finally, distinct features of the paper are that it explains receiving and sending flows as a function of an array of institutional and economic country variables and those trends in asset flows among EMU and non-EMU countries are evaluated controlling for world wide trends in internationalization.

Research on European banking integration has been taken place for several years, some times sponsored by the European Central Bank (ECB) itself, as ECB (2003a) and Trichet (2003). Dermine (2002), Cabral, Dierick and Vesala (2002) provide a comprehensive empirical overview of cross border banking activity using data on prices and quantities and looking at wholesale as well as retail banking services. More recently, Baele et al (2004) present an overview of the state of financial integration in the Euro area, including, money, government bond, loan and deposit and equity markets, and the European Commission has established a regular monitoring of financial integration, European Commission (2004). Quiros and Mendizabal (2001), Danthine et all (2000) and Fernández de Guevara et al (2003) view banking integration mainly from the law of one price and convergence in interest rates and margins. On the other hand, Manna (2004) studies banking integration using cross border quantity flows for several banking assets using non consolidated bank level data, and calculating several measures of integration[3]. The dominant conclusion in these studies is that financial integration in general, and banking integration in particular, is evolving at a different pace

2. Papaioannou (2005) studies the determinants of international bank flows using BIS locational international banking statistics. Locational data refers to international financial claims and liabilities of banks resident in a given country, while consolidated data uses as creditor reporting basis the nationality (home country) of the lender on a worldwide consolidated basis, net of inter-office accounts (i.e. net of internal transactions between subsidiaries and the parent bank). We believe that consolidated data has several advantages to study banking integration, compared with locational data, since it provides a measure of the risk exposure of lenders' national banking systems and avoids double counting. One limitation of the consolidated data is that, to our purposes, it is only available since 1999.

across financial instruments and services. Integration appears higher in money markets and interbank markets and lower in retail banking.

Our paper uses flows of cross border activity with banking assets, but differs from previous research in European banking integration in that it uses BIS data on international assets. The data refer to flows from consolidated banks, a clear advantage to avoid double counting compared to using unconsolidated balance sheet data (see footnote 2). Second, the paper measures the effect of the Euro in the integration process controlling for the general trend in international flows of banking assets inside and outside the Euro and the European Union. Third, preliminary evidence is provided on institutional and economic forces behind integration, both for countries inflows and for countries outflows of banking assets. Four, in order to gain some insights in future developments after enlargement of the EU, the paper measures integration with and without New Member States. The analysis has the limitation that only data on aggregate flows is available and therefore the analysis at the level of several products as in Manna (2004), it is not possible.

We find evidence that cross country flows of banking assets in the Euro zone is progressing at a faster pace than the general trend in financial services integration world wide, an indication that the single currency is in fact stimulating the process. This is true for assets received from other Euro area countries. Second, the Euro alone is by itself an institutional factor that enhances integration after controlling for factors that tend to explain why outflows and inflows are more important in some countries than in others[4]. Third, banking services of NMS are already well integrated into the European Union and at this point in time the measures of integration give similar values when applied to these countries alone as when they are applied to the enlarged area. The main reason for this is that significant parts of the banking system of most of the NMS are already under the control of

3. A more complete list of references to papers on European financial integration that goes further back in time can be found in Manna (2004). Rajan and Zingales (2003) view integration of financial markets within the context of banking versus non intermediated financial markets and convergence in models of corporate governance and control.

4. In the spirit of La Porta et al (1998), Beck et al (2001), Rajan and Zingales (2003) and Caprio et al (2003).

banks from EU-15 countries[5].

The rest of the paper is structured as follows. Section 2 contains a discussion about the meaning and evaluation of banking integration. Section 3 describes the indicators used in this paper, and analyze their evolution over time in the period of study. Section 4 reviews some of the economic and institutional factors behind banking integration, and presents evidence about the explanatory power of these factors to account for differences in openness and internationalization of European countries. Section 5 draws some policy implications of the findings for banking supervisors. Finally, section 6 concludes the paper.

2. MEANING AND EVALUATION OF BANKING INTEGRATION

The introduction of the Euro is one of the many, although especially important, steps towards what has been called the Single European Market. Broadly, a "single market" means that all buyers and sellers within the boundaries of the Union have ex ante equal opportunities to trade among themselves, independently of the country in which buying and selling takes place. A single currency contributes to the creation of a single market if it increases the number of buyers and sellers that can potentially enter into profitable transactions and/or it evens the opportunities to transact towards the more favorable ones in terms of welfare creation. The Euro is expected to make this kind of contribution as long as it eliminates the exchange rate risk; increases price transparency and, overall lower transaction costs[6].

Financial markets and banking markets, in particular, share the common potential benefits of a single currency and have other especially relevant ones. The introduction of the Euro goes together with

5. However, this may create new supervisory challenges. See Magyar Nemzeti Bank (2004) and Quinn (2004), for supervisory challenges, and see Claessens et al (2000) and Crystal et al (2001) for a review of the benefits of foreign ownership of the banking system from the point of view of regulation and prudential supervision.

6. Baele et al (2004) define an integrated financial market as a market where all potential participants with the same characteristics, i) face a single set of rules when dealing with financial instruments or services; ii) have equal access to the services and iii) receive an equal treatment. They propose a number of measures to evaluate the state of the evolution of financial integration in money, corporate bond, government bond, credit and equity markets, that are partially inspired in those proposed by Adam et al (2002) on their report for the European Commission.

the creation of a European Central Bank in charge of the monetary policy decisions for the whole Euro-countries. This means the same basic interest rate for all country members and, if there is one price, there must also be one market (single interbank market). Second, the reduction of transaction costs will stimulate trade more intensively in those goods and services that have lower transportation or other costs originated from the physical movement of goods and services. Financial transactions are, in many cases, virtual transactions as they imply book keeping notations but no physical movements of goods and services at all, so lower transaction related costs (contractual costs) should have a positive effect in stimulating trade of financial services. Not all, of course, since for many customers there are high perceived benefits from physical proximity and face to face transactions for example in retail banking activities and relationship lending between banks and firms. According to Guiso et al (2004) European financial integration will accelerate the development of the most backward financial markets and this development can produce a sustained additional growth of GDP in the EU countries of 0.2% yearly.

European financial and banking integration can then be viewed as a process converging into a single market for financial/banking products and services, where all buyers and sellers within the Union have opportunities to transact in the most favorable terms. The Euro and the removal of regulatory and institutional barriers to trade and to cross-country investments can stimulate banking integration, but there is also interest in knowing if expectations are actually fulfilled. In this respect, studies on banking integration have focused on ex post evaluation of the actual progresses being made towards the single market, looking at price convergence and at the actual flows of goods and services.

A single market must be matched by only one price for the product that defines the market. The so-called law of one price is the benchmark for studies on banking integration that focus on interest rate convergence after the Euro; Quiros and Mendizabal (2001), Fernández de Guevara et al (2003), Baele et al (2004). Less interest rate dispersion among countries together with convergence towards the lowest prevailing interest rate in loans and the highest in deposits will confirm that the Euro stimulates banking integration and increases social welfare.

Tests of the law of one price require a proper definition of the relevant market. Consumers' transportation costs and potential gains of relational banking create conditions for geographic market segmentation so that in the case of retail banking the relevant market can be a local area grouping several bank branches. Second, product differentiation efforts and investment in borrowers' and depositors' specific information by banks, in response to the increase in competition, can "customize" the banking relationship and increase interest rate differences among banks, Boot and Thakor (2000). Finally, interest rate dispersion among EU countries will be sensitive to the evolution of the monetary conditions and, in particular, to the evolution of the interbank interest rate. The latter can distort the conclusions of interest rate converge due to the single currency effect. To see this, notice that the equilibrium profit maximizing interest rate of deposits in market i, assuming Cournot type competition, will equal to,

$$R_{di} = R\frac{n_i \varepsilon_{di}}{n_i \varepsilon_{di} + 1}$$

where R_{di} is the equilibrium interest rate in deposits in country i, n_i is the number of banks in the market, ε_{di} is the supply elasticity of deposits and R is the interbank interest rate, the same in all Euro countries after the introduction of the single currency (we assume zero marginal operating costs). The standard deviation of R_{di} can be used as a measure of interest rates dispersion.

Once the interbank interest rate R is the same in all countries dispersion of interest rates is explained in terms of differences in structural conditions, number of banks, elasticity of deposits' supply, across markets. If R remains stable over time and the Euro creates positive conditions for convergence in structural conditions across markets, then the introduction of the Euro will coincide with the start of a process of convergence in interest rates. But notice that for given structural conditions dispersion of interest rates across countries varies over time with changes in the interbank interest rate R. Before the Euro, dispersion in interest rates across EU countries reflected both, differences in structural conditions and differences in interbank interest rates. After the Euro interbank interest rate differences disappear and for this reason some convergence in interest rates can be expected even if the structural conditions in each country remain unchanged. The observed decreasing trend in the interbank

interest rate set by the ECB in recent years also has to be accounted for to explain convergence in interest rates across countries beyond potential changes in structural conditions.

Studies of banking integration focusing on quantities instead of prices base their conclusions on the expected changes in equilibrium market shares when the enlargement of a market coincides with a change in the comparative relative competitive advantages of the firms in old markets, Manna (2004). Under the same Cournot competition conditions assumed above, equilibrium market shares of deposits of banks in a market will be inversely related to marginal operating costs, i.e. more efficient banks will have larger equilibrium market share. If initially segregated national banking markets evolve into a single market, national banks will start to compete and those more efficient will gain share at the expense of the less efficient ones. Cross border flows of deposits may be observed in response to the new competitive conditions, which just reflect the transition from the old to the new equilibrium. To make effective the potential gains in share, more efficient banks may have to undertake direct foreign investment, for example open branches or to purchase existing branch networks in the country they are entering, that will also be part of the cross countries flows of banking assets.

From this perspective, and assuming that before the Euro and before the true economic conditions for a single market the differences in efficiency among banks of different countries were important, banking integration will be far away from symmetric flows of banking assets across countries. Rather, flows towards countries that have more efficient banks should increase at the expense of those with more inefficient ones. The new structure of banking markets in the enlarged European market can differ from the old in many ways, including number of surviving banks and their respective specialization in segments of banking products as a function of their comparative competitive advantage in each of the segments. Universal banks may divest some activities in which they are not competitive and concentrate all the efforts in a core of services in which they are particularly efficient, to the point of becoming more specialized in products but more diversified in geographic markets.

In this scenario, equilibrium interest rates of homogeneous products will be the same in all banks, although each of them can have different market shares and profits. If economic markets extend beyond country borders then convergence in interest rates among

countries will just reflect the characteristics of the market. But if banks differentiate products and cost is no longer the only source of competitive advantage then market boundaries are difficult to identify and the interest rate differences among banks and countries may persist even if there are cross-country flows of banking assets. Finally, high differences in efficiency among banks may incentive spur mergers and acquisitions and increase concentration in certain product and geographic markets even if the total market has enlarged. The efficiency effect behind market concentration will also push towards more favorable interest rates from a welfare point of view, but collusion practices can be easy to implement in markets with less number of competitors. Thus, the net effect of banking integration from the perspective of the cross-country flows of banking assets is an open question.

As indicated in the introduction, this paper focuses on flows of banking assets across EU countries to calibrate banking integration in the Euro era. The main purpose of the exercise is to provide evidence of the amount of these flows without making any welfare inference of this evidence. The underlying assumption is that the Euro creates conditions where more efficient banks can gain market share over less efficient ones and, as a result, there will be an increasing trend in cross country flows of banking assets in the Euro area in the process towards the new equilibrium. More flows will be interpreted as an indication of higher integration, assuming that the opportunities for reallocation of assets are high because the initial differences in efficiency are also high.

3. SOME QUANTITY INDICATORS OF EUROPEAN BANKING INTEGRATION

So far, flows of banks' assets across European countries have been approximated in different ways, for example interbank exposures, deposits, loans, shares and securities holdings, branches, mergers and acquisitions[7]. However, there is another piece of information that potentially might be useful for this purpose but has been ignored so far. That information comes from BIS reporting on foreign assets by

7. See, in particular, Cabral et al (2002), Baele et al (2004), Manna (2004) and European Commission (2004).

banking systems of developed countries. Those assets are broken down by country of destination (i.e. not only contains information across developed countries but also of banking assets held in emerging markets by, mainly, banks of developed countries). In this section, some indicators of international activity at the country level and for the Euro area and the European Union as a whole are presented, together with measures of them for the years 1999 to 2003.

The assets reported by banks to BIS are financial assets. Thus, they include government debt held by banks as well as interbank exposures and loans to the private sector plus equity of financial and non-financial firms. The data is reported at a consolidated level. Therefore, cross operations between the parent bank and its subsidiaries abroad have been properly eliminated. That is very important in order to avoid double counting of foreign assets. An individual or solo bank approach might bias the amount of foreign assets abroad. For instance, if a parent bank lends funds to a subsidiary or a branch in a foreign country and that subsidiary or branch uses the funds to make loans in that country, individual reporting might add up both the assets of the subsidiary or the branch and the loan from the parent to fund the assets being hold in that country. On the contrary, a consolidated approach will net out the flow between the parent and the subsidiary and avoid double counting of foreign assets; which is an important advantage of consolidated statistics versus locational statistics. Moreover, BIS data is reported by banks and does not include, for instance, assets of money market mutual funds.

Country breakdown of foreign assets, both at the level of reporting and non-reporting countries, is only available since 1999. Thus, it is not possible to determine a direct impact of Euro on banking integration from this data. However, we are more interested in medium term trends since the impact must be not of an impulse-type but, rather, more progressive through time[8].

The introduction of the Euro is likely to modify the amount of foreign bank assets held in other Euro zone countries. Since January 1999 exchange rate risk disappeared, so banks might be keener to hold debt or equity issued in other Euro countries. Moreover, they

8. Rajan and Zingales (2003) test quite crudely the impact of euro using a dummy variable that takes value of 1 from 1999 onwards and 0 otherwise. Thus, their hypothesis is that the euro has a sudden and permanent change. However, it seems more reasonable to expect that the institutional framework changes only slowly to the appearance of the Euro, in particular in banking markets (out of interbank and, to a lesser extend, wholesale markets).

might be less reluctant, for the same reason, to lend to foreign banks operating in the area. For the same token, and since integration is a two way process, countries will receive more banking assets from abroad than when each country had its own currency. Absolute indicators might be influenced by the general trend in bank assets, both domestic and foreign. Therefore, we should focus on relative magnitudes (i.e. percentage of foreign assets over total banking assets or GDP).

Some indicators of European banking integration: outflows and inflows of banking assets relative to total banking assets and GDP

The first indicator of cross border activity, I1, is the amount of bank assets of a given country that are owned by foreign banks, over total banking assets of the receiving country. The second indicator of cross border activity, I2, measures the assets held abroad by banks of a given country, relative to the total banking assets of the sending country. The indicator I1 gives an indication of the degree of *openness* to foreign banking activity of a particular country, while I2 indicates the *internationalization* of the banks of a given country.

Total assets of each national banking system are only available, in a homogeneous way, for EU countries and only up to 2002[9]. In order to expand our field of comparison and see if developments are different among Euro zone and/or EU countries and the other developed countries that report information to BIS on foreign assets, we modify the indicators I1 and I2 to normalize the absolute flows in terms of GDP instead of total assets, since data on GDP is available for all countries. When necessary, the indicators normalized by the GDP of the country will be identified as I21 and I22, respectively.

From Table 1, Panel A, column **Received**, we see that the amount of "openness" of national banking systems to foreign bank assets from other Euro area countries (I1) is relatively low. The weighted average of national figures, which can be considered a measure of European integration that takes into account the size of the receiving country, is around 10% during the period under study. However, the simple average is around 15% indicating that smaller countries are

9. See, ECB (2003b).

more open than larger ones, as one could expect. In particular, France and Germany appear as countries quite closed to the presence of foreign banks, since their figures of openness are quite below the average. Nevertheless, in weighted (simple) averages there is a tentative trend towards more open banking systems in the Euro area starting from 1999, since assets received from foreign banks of other Euro area countries were 8.6% (13%) of the total banking assets of the country in 1999, and go up to 11.1% (17%) in 2002.

Regarding the foreign assets that banks from a country hold in the other Euro area countries, (I2), from Table 1, Panel A, column **Sent**, again the average level is low and there are less differences across countries according to their size (simple and weighted averages are quite similar). Belgium and Netherlands, two small countries with some large *bancassurance* groups operating in both countries, are the two countries clearly with more internationally active banks in the Euro zone. Again, a tentative increasing trend towards internationalization can be perceived, from 8.6% in 1999 to 12.1% in 2002.

If the whole European Union is considered, bottom of Table 1, Panel B, integration measures increase in value around 2 percentage points (pp) and also show an increase along time. In particular, UK, one of the major world financial centers, appears as integrated as the rest of the EU countries, specially in terms of bank assets received, I1, but much less in terms of banking activity abroad, I2. Moreover, Sweden and UK show no trend in the measures of integration over time.

Data in Table 1 is summarized in Chart 1, which also includes the average aggregate measure of integration computed with GDP as normalization factor in order to provide preliminary information about the integration trend in year 2003. The observation of the chart, as well as the country level data not reported to save space, confirms that in year 2003, the trend of banking integration continues at the pace initiated years before.

Table 2, constructed in a similar way as Table 1 with GDP as a normalisation factor, allows us to compare observed trends in internationalization within the European Union with trends in all developed countries. Large developed countries as Japan and USA are relatively closed countries as they hold abroad, among developed countries, fewer assets than large European countries. Japan appears more active sending assets abroad than receiving them, while for the USA the reverse is true. In this larger sample of countries UK shows a sim-

Table 1
"Total Foreign Claims" as percentage of Total Banking Assets of each country

Panel A: Total foreign claims received/sent from/to the Euro Area

	Received (I1)				Sent (I2)			
	1999	2000	2001	2002	1999	2000	2001	2002
Austria	12.32	13.70	25.27	24.69	6.22	7.49	3.89	4.50
Belgium	14.60	15.46	15.98	22.98	26.08	30.87	32.86	36.74
Finland	14.57	18.09	14.15	13.16	5.84	6.69	3.52	3.34
France	5.71	6.68	6.27	7.02	8.39	7.55	7.26	9.22
Germany	4.07	3.60	3.58	5.35	7.80	9.08	10.66	10.53
Ireland	21.28	21.49	21.49	23.36	2.23	2.94	3.14	
Italy	16.40	16.91	16.94	16.71	4.57	5.43	5.14	5.70
Netherlands	17.55	18.78	18.97	19.52	12.81	11.66	11.58	24.05
Portugal	13.31	20.30	20.29	24.45	4.94	3.88	3.92	5.46
Spain	9.75	10.72	10.43	12.95	7.46	8.93	8.46	8.99
Weighted average	8.55	9.16	9.58	11.13	8.55	9.16	9.58	11.45
Simple average	12.96	14.57	15.34	17.02	8.64	9.45	9.04	12.06

Sources: Total Foreign Claims from BIS (http://www.bis.org/statistics/consstats.htm) and **Total Banking Assets from ECB** (2003b)

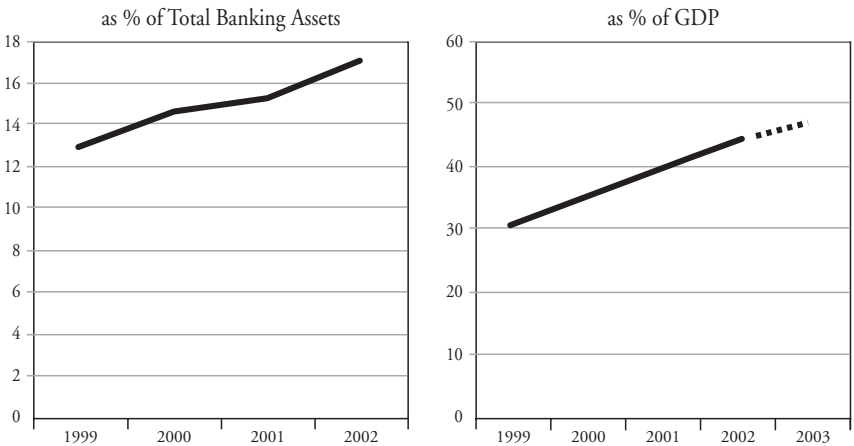
Panel B: Total foreign claims received/sent from/to the EU-15

	Received (I1)				Sent (I2)			
	1999	2000	2001	2002	1999	2000	2001	2002
Austria	13.66	15.04	26.62	26.09	8.60	10.38	5.02	5.73
Belgium	16.89	17.93	18.08	25.86	34.56	40.82	42.56	50.84
Finland	24.02	31.35	23.80	22.34	15.33	21.83	22.39	20.44
France	6.73	9.21	8.63	9.32	11.24	10.47	10.25	12.37
Germany	4.85	5.29	5.27	6.56	12.89	15.93	19.66	19.37
Ireland	27.37	28.08	28.94	31.80	14.34	16.40	15.73	
Italy	18.12	19.57	19.47	19.54	7.42	8.16	7.78	8.50
Netherlands	19.47	21.13	21.51	22.82	18.32	19.26	18.20	34.29
Portugal	14.53	21.97	22.52	27.45	6.88	5.91	6.20	7.25
Spain	11.31	12.42	12.12	15.24	9.23	11.39	10.75	11.45
Denmark	10.05	13.10	15.24	16.00	6.86	8.37	7.31	7.54
Sweden	14.22	16.26	15.88	14.05	11.68	23.21	19.86	13.69
UK	13.51	15.34	16.31	14.89	4.08	5.70	5.52	5.48
Weighted average	10.78	12.48	13.08	14.32	10.78	12.48	13.08	14.60
Simple average	14.98	17.44	18.03	19.38	12.42	15.22	14.71	16.41

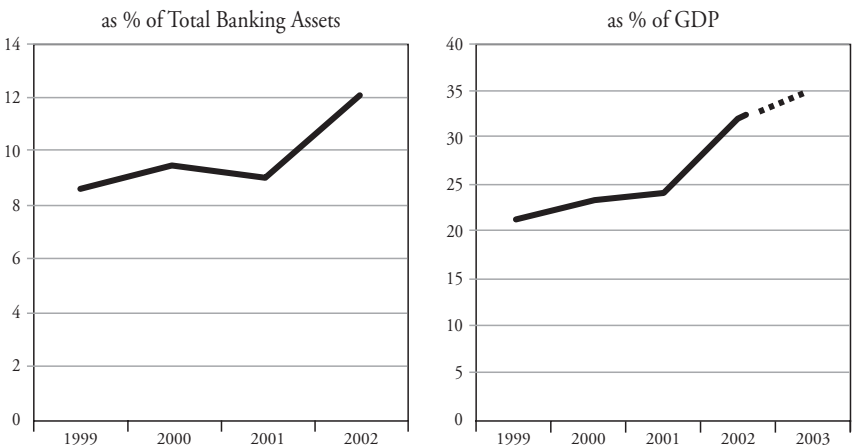
Sources: Total Foreign Claims from BIS (http://www.bis.org/statistics/consstats.htm) and **Total Banking Assets from ECB** (2003b)

Chart 1.
Evolution of "Total foreign Claims" (Received and Sent), as % of Total Banking Assets and GDP. Simple Average of countries belonging to the Euro Area

Panel A: Received



Panel B: Sent



ilar proportion of banking assets sent and received. In any case, Table 2 confirms that the trend towards more banking integration is common among developed countries, evidence that should be taken into account when evaluating the effect of Euro in such integration.

Overall, Tables 1 and 2, as well as Chart 1, show a low, in particular for large countries, although increasing trend towards banking systems integration. That effect is quite clear among European Union countries and Euro area countries as well[10].

Table 2
"Total Foreign Claims" as percentage of GDP of each country

Total foreign claims received from the developed countries declaring to the BIS and sent to all country destinations

	Received (I21)					Sent (I22)				
	1999	2000	2001	2002	2003	1999	2000	2001	2002	2003
Austria	38.29	45.95	79.79	74.94	72.74	48.34	60.05	29.42	33.25	38.65
Belgium	69.73	62.74	71.32	92.85	94.55	153.30	175.61	199.76	223.83	217.97
Canada	18.53	20.09	20.69	20.46	18.83	44.85	42.88	48.44	45.09	42.94
Finland	28.31	37.45	34.95	31.95	24.42	24.47	29.72	42.87	41.18	35.70
France	24.02	29.97	29.54	32.44	33.67	58.14	60.37	62.01	72.83	77.59
Germany	21.79	25.70	27.82	31.61	32.55	81.95	100.02	118.58	109.87	100.58
Ireland	110.05	122.27	133.84	142.26	181.01	78.82	91.15	92.88		
Italy	31.73	35.75	35.94	38.89	39.28	21.90	26.52	25.14	26.00	22.39
Japan	8.55	7.62	8.59	8.98	10.92	22.97	24.46	28.14	28.64	28.77
Netherlands	66.45	79.44	81.25	87.43	96.76	101.46	109.28	108.14	220.42	232.13
Norway	26.89	29.75	35.96	42.79	37.19	2.20	7.96	6.68	6.86	7.75
Portugal	43.77	64.92	68.58	79.99	113.11	39.24	39.88	36.32	36.46	46.27
Spain	24.70	28.11	28.08	35.39	38.64	42.37	63.44	59.22	52.33	48.82
Denmark	30.31	42.16	49.90	54.60	42.30	28.89	31.60	28.96	31.68	38.81
Sweden	30.72	35.84	40.86	38.47	36.23	36.04	60.90	63.95	57.17	135.67
Switzerland	39.91	52.06	55.03	51.40	43.57	372.60	401.86	432.39	478.91	495.73
UK	76.75	86.26	90.17	90.20	94.17	59.24	73.98	80.59	86.56	91.07
US	20.27	22.46	24.39	27.46	30.14	7.36	7.61	7.98	7.15	7.72
Weighted average	25.08	27.50	30.06	33.54	36.25	34.94	37.76	41.01	44.19	47.70
Simple average	39.49	46.03	50.93	54.56	57.78	68.01	78.18	81.75	91.66	98.15

Sources: Total Foreign Claims from BIS (http://www.bis.org/statistics/consstats.htm) and **GDP from OECD** (Main Economic Indicators, January 2004)

New Member States

Regarding New Member States, we only have information of the flows received from developed countries and not from the flows they send abroad. Nevertheless, the latter are probably much less important in quantitative terms since banks from those countries are mainly local and, more importantly, the foreign ownership of those banks is quite high. In four of the countries the market share of banks

10. Papaioannou (2005), with BIS locational statistics, also finds evidence of increasing banking integration in Euro countries after the introduction of the single currency.

owned by foreigners is above 85%, while in 3 countries is around two thirds. Only the banks in the smallest countries, especially Malta and Cyprus, seem to have maintained their independence[11]. Again, we only have data from 1999 onwards and we can only compute the indicators based on GDP measures since we do not have total banking assets of the countries along time.

Table 3, Panel A, shows that New Member States, in simple average terms, tend to receive a similar percentage of foreign assets as Euro zone countries. However, in terms of weighted averages, the importance of the flows received is higher (around 10 pp the last three years). If we take into account that the relative weight of total banking assets in terms of GDP is much higher in the Euro zone countries (Caviglia et al, 2002), this is an additional indication of the importance of foreign assets in the NMS banking systems.

Table 3 also shows that there is a clear trend towards an increase in the openness of these countries that might reflect the growing interest of Euro zone banks in those emerging countries that, finally, joined the EU in May 2004. In this sense, it is interesting that in 1999 and 2000 simple average is higher than weighted average, an indication that small countries were receiving more banking assets. Nevertheless, differences between simple and weighted average have vanished over time, an indication that bigger countries have become also an attractive destinations of funds for Euro zone banks.

Table 3, Panel B, shows even higher degrees of openness when we take into account those countries members of the EU-15 that are not in the Euro zone. In particular, the increase is more significant in the Baltic Republics (as a result of the flows coming from Sweden) and Malta (from UK) for geographical and historical reasons. Finally, openness increases a few percentage points when we add the flow of funds received from all developed countries as shown in Table 3, Panel C.

Chart 2 shows that among developed countries, those from the Euro zone are the ones that have more foreign assets in NMS. The historical relationships between those groups of countries coupled with proximity, which helps to explain higher flows of economic transactions, might be the explanatory factors. However, some banks from countries with less historical relationships are also present in New Member States while other internationally active banks from

11. See, Caviglia et al (2002).

Table 3.
'Total Foreign Claims' received by New Member States as percentage of GDP of each country

Panel A: Total foreign claims received from Euro Zone

	1999	2000	2001	2002	2003
Cyprus	52.10	56.72	51.91	41.24	43.58
Czech Republic	30.15	42.89	51.09	51.27	65.08
Estonia	12.75	11.82	14.96	20.61	18.58
Hungary	36.52	43.07	43.55	46.39	51.98
Latvia	6.15	7.47	12.48	16.76	15.94
Lithuania	6.11	6.34	6.76	10.93	12.70
Malta	65.64	75.22	78.84	69.41	107.75
Poland	11.41	22.32	29.39	30.72	31.45
Slovakia	22.03	19.83	21.19	50.38	48.74
Slovenia	9.94	14.74	21.51	26.30	32.03
NMS, Weighted average	19.98	28.33	33.69	37.14	41.90
NMS, Simple average	25.28	30.04	33.17	36.40	42.78
EMU, Weighted average	20.23	22.18	23.74	27.93	29.47
EMU, Simple average	30.99	35.25	39.82	44.61	47.67
Total, Weighted average	20.22	22.52	24.33	28.49	30.20
Total, Simple average	28.13	32.64	36.49	40.51	45.23

Note: Ireland is excluded because it does not report to the BIS with this level of detail.

Panel B: Total foreign claims received from EU-15

	1999	2000	2001	2002	2003
Cyprus	59.87	64.64	60.04	49.54	52.29
Czech Republic	30.88	44.01	52.14	52.28	66.48
Estonia	36.53	65.46	67.97	76.74	18.94
Hungary	37.76	44.50	45.08	47.60	53.00
Latvia	12.98	18.16	28.47	28.10	15.97
Lithuania	7.52	18.88	21.92	20.44	12.77
Malta	148.93	157.01	159.67	156.33	204.20
Poland	11.95	22.85	30.01	31.47	32.01
Slovakia	22.66	20.49	21.65	50.87	49.74
Slovenia	10.27	15.10	21.57	26.34	32.21
NMS, Weighted average	22.28	31.63	37.09	40.41	43.80
NMS, Simple average	37.94	47.11	50.85	53.97	53.76
EU-15, Weighted average	26.00	30.82	33.91	37.89	40.65
EU-15, Simple average	34.38	39.31	45.51	49.71	56.01
Total, Weighted average	25.86	30.85	34.06	38.01	40.79
Total, Simple average	35.93	42.70	47.83	51.56	55.03

Note: Ireland and Denmark are excluded because they do not report to the BIS with this level of detail.

Table 3.
'Total Foreign Claims' received by New Member States as percentage of GDP of each country

Panel C: Total foreign claims received from Developed Countries declaring to the BIS

	1999	2000	2001	2002	2003
Cyprus	64.39	69.10	64.38	55.17	58.14
Czech Republic	34.15	46.66	54.73	55.46	69.45
Estonia	37.40	66.22	71.60	77.41	19.59
Hungary	42.22	49.80	49.56	51.95	56.02
Latvia	13.87	18.60	28.81	28.30	16.16
Lithuania	9.94	20.91	23.23	21.72	13.15
Malta	152.50	163.09	167.02	164.19	213.27
Poland	14.13	27.20	33.981	35.66	36.01
Slovakia	28.34	25.45	27.03	55.26	52.99
Slovenia	10.76	15.89	22.07	26.84	32.69
NMS, Weighted average	25.10	35.47	40.60	44.10	47.03
NMS, Simple average	40.77	50.29	54.23	57.20	56.75
Developed, Weighted average	23.60	25.88	28.33	32.06	34.82
Developed, Simple average	37.95	44.08	48.77	52.95	55.94
Total, Weighted average	23.62	26.02	28.52	32.27	35.04
Total, Simple average	38.96	46.30	50.72	54.47	56.23

Note: Ireland, Denmark, Canada and Norway are excluded because they do not report to the BIS with this level of detail.

Chart 2.
"Total Foreign Claims" send to New Member States from different regions

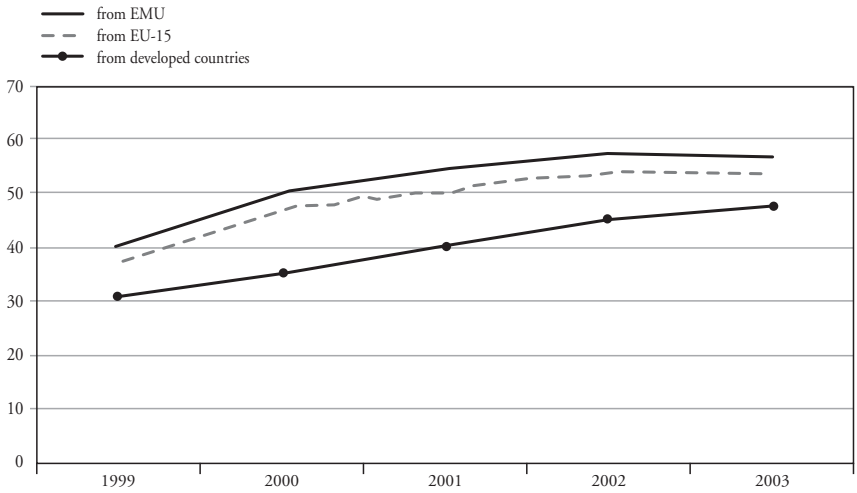


Table 4.
'Total Foreign Claims' sent to New Member States as % of GDP of each country

	1999	2000	2001	2002	2003
Austria	3.57	5.73	4.60	5.78	7.86
Belgium	4.30	7.92	11.36	12.83	12.84
Finland	0.38	0.54	1.16	1.78	1.21
France	0.41	0.38	0.84	0.86	1.44
Germany	1.50	1.93	2.73	3.02	3.14
Italy	0.27	1.50	1.74	2.09	2.09
Netherlands	2.47	2.88	2.56	3.14	3.14
Portugal	0.11	0.23	0.31	0.23	0.22
Spain	0.08	0.08	0.10	0.09	0.11
EMU, Weighted average	1.09	1.68	2.16	2.46	2.67
EMU, Simple average	1.45	2.35	2.82	3.31	3.56
Sweden	0.89	2.32	3.17	3.05	0.31
United Kingdom	0.40	0.41	0.41	0.42	0.48
EU-15, Weighted average	0.96	1.46	1.86	2.08	2.20
EU-15, Simple average	1.31	2.17	2.63	3.03	2.98
Switzerland	0.63	0.72	0.83	0.92	0.77
United States	0.07	0.10	0.10	0.11	0.11
Japan	0.04	0.04	0.04	0.04	0.05
Total, Weighted average	0.39	0.55	0.70	0.81	0.93
Total, Simple average	1.08	1.77	2.14	2.45	2.41

Note: Ireland, Denmark, Canada and Norway are excluded because they do not report to the BIS with this level of detail.

large countries have not shown much interest until now. Belgian and Austrian banks have been very active in relative terms (Table 4) while German, Dutch, Italian and French banks have a lower penetration, in terms of their GDP. Spanish banks have played a marginal role.

The former result is, partially, the result of the different strategies of internationalization carried out by banks. Austrian, Belgian, and Finish banks concentrate in NMS more than half of their foreign assets in emerging markets (Table 5). Moreover, that percentage has increased systematically and significantly since 1999. On the other hand, Dutch, French and German banks concentrate in Eastern Europe less than one third of the foreign assets in emerging markets. It seems that, banks from smaller countries, which may appear initially as less internationally active banks, are trying to exploit competitive advantages focusing increasingly in New Member States

Table 5.
'Total Foreign Claims' sent to New Member States as percentage of total foreign claims sent to emerging markets

	1999	2000	2001	2002	2003
Austria	34.56	40.99	51.86	53.86	58.59
Belgium	51.18	58.83	71.95	72.27	73.73
Finland	18.55	23.17	39.56	62.59	66.42
France	5.36	5.16	11.41	11.53	18.27
Germany	16.59	19.57	25.45	30.43	31.88
Italy	8.16	27.09	31.42	38.96	45.49
Netherlands	12.02	14.12	13.42	16.58	16.06
Portugal	4.52	9.45	10.91	8.44	10.02
Spain	0.46	0.25	0.32	0.41	0.58
EMU, Weighted average	12.23	14.80	19.12	23.33	26.22
EMU, Simple average	16.82	22.07	28.48	32.79	35.67
Sweden	45.04	64.39	68.24	72.47	0.58
United Kingdom	5.10	4.42	4.60	4.36	5.04
EU-15, Weighted average	11.29	13.63	17.43	20.51	19.32
EU-15, Simple average	18.32	24.31	29.92	33.81	29.70
Switzerland	4.21	4.90	5.47	5.96	4.17
United States	3.12	4.68	3.82	5.38	5.26
Japan	1.90	2.13	1.80	2.13	2.64
Total, Weighted average	8.68	11.01	13.26	16.43	16.26
Total, Simple average	15.05	19.94	24.30	27.53	24.19

Note: Ireland, Denmark, Canada and Norway are excluded because they do not report to the BIS with this level of detail.

while larger banks from larger countries follow a more diversified strategy with a significant presence in all the markets.

NMS in the portfolio of foreign banking assets of banks world wide

The internationalization strategy of banks can separate foreign investment decisions that involve developed countries and decisions involving emerging ones. In order to provide additional evidence on how the enlargement of the European Union can affect banking integration it may be of interest to evaluate the flow of banking assets to NMS in the context of investment strategies towards emerging coun-

Table 6.
Portfolio structure over time

Panel A: Sent by EMU

	Developed							Developing							Other
	Total	EU			Japon	US	Other Developed	Total	Africa	Asia	Europe			Latam	
		Total	EMU	Other							Total	NMS UE	Other		
1999	75.55	50.21	33.34	16.87	2.45	13.98	8.92	15.68	1.87	2.91	3.49	2.05	1.45	7.41	8.77
2000	73.29	49.43	30.76	18.66	2.14	13.73	7.99	17.58	1.81	2.47	4.56	3.05	1.51	8.74	9.13
2001	74.62	49.73	30.48	19.26	2.07	13.09	9.72	18.27	1.93	2.05	5.74	4.22	1.52	8.55	7.11
2002	77.78	51.63	33.04	18.59	1.90	14.59	9.66	16.41	1.74	1.59	6.39	4.63	1.76	6.69	5.82
2003	79.15	54.59	35.26	19.34	2.25	13.56	8.75	15.63	1.44	1.54	6.99	5.09	1.88	5.67	5.22

Note: Ireland is excluded because it does not report to the BIS enough detail in emergin markets

Panel B: Sent by EU-15

	Developed							Developing							Other
	Total	EU			Japon	US	Other Developed	Total	Africa	Asia	Europe			Latam	
		Total	EMU	Other							Total	NMS UE	Other		
1999	75.91	47.94	31.26	16.67	2.68	15.61	9.68	14.53	1.82	2.99		3.23 1.96	1.26	6.49	9.56
2000	74.26	48.56	30.97	17.59	2.17	15.12	8.41	16.05	1.75	2.55		4.20 2.89	1.31	7.55	9.68
2001	75.13	48.51	30.56	17.95	2.10	14.61	9.91	16.62	1.84	2.18		5.26 3.95	1.31	7.35	8.25
2002	77.91	49.15	31.31	17.83	1.95	16.58	10.23	15.10	1.68	1.78		5.81 4.31	1.50	5.82	6.99
2003	76.65	51.51	34.85	16.66	2.12	14.70	8.31	17.37	1.42	1.73		5.83 4.23	1.58	8.39	5.98

Note: Ireland and Denmark are excluded because they do not report to the BIS enough detail in emergin markets

Panel C: Sent by Developed Countries declaring to the BIS

	Developed							Developing							Other
	Total	EU			Japon	US	Other Developed	Total	Africa	Asia	Europe			Latam	
		Total	EMU	Other							Total	NMS UE	Other		
1999	75.62	45.61	28.52	17.09	3.36	19.25	9.01	14.53	1.72	3.62		2.77 1.63	1.14	6.42	9.85
2000	74.85	45.78	28.06	17.72	2.98	19.52	8.18	15.41	1.63	3.08		3.57 2.39	1.18	7.13	9.74
2001	75.28	45.25	27.94	17.31	2.83	19.58	9.21	16.09	1.68	2.73		4.35 3.21	1.14	7.33	8.63
2002	77.78	46.24	29.06	17.17	2.58	21.01	9.63	14.60	1.54	2.41		4.83 3.52	1.31	5.82	7.62
2003	76.82	48.22	31.81	16.41	2.78	19.18	8.20	16.25	1.32	2.42		4.84 3.45	1.38	7.66	6.94

Note: Ireland, Denmark, Canada and Norway are excluded because they do not report to the BIS enough detail in emergin markets

tries. The study of global portfolios of foreign banking assets of the countries we follow in this study may provide some valuable information in this respect.

Table 6, Panel A, shows that since 2000, one year after the intro-

Table 7.
Ordinary Least Square regression of 'Total Foreign Claims' as % of GDP as a function of country, time and euro/new member state variables

	Received			Sent
	Coeffcient (1)	Coeffcient (2)	Coeffcient (3)	Coeffcient (4)
Austria	--	--	-21.24 ***	--
Belgium	15.90 ***	15.57 **	-5.67	152.17 ***
Canada	-67.80 ***	-62.86 ***	-62.86 ***	-33.46 **
Finland	-30.92 ***	-39.76 ***	-39.76 ***	-7.15
France	-32.40 ***	-31.50 ***	-52.74 ***	24.26 *
Germany	-34.45 ***	-31.78 ***	-53.03 ***	60.27 ***
Ireland	67.33 ***	-34.20 ***	-55.45 ***	53.64 ***
Italy	-26.01 ***	70.54 ***	49.30 ***	-17.54
Japan	-78.59 ***	-25.39 ***	-46.63 ***	-51.69 ***
Netherlands	19.94 ***	-73.75 ***	-73.75	112.35 ***
Norway	-53.00 ***	19.66 ***	-1.58 ***	-72.00 ***
Portugal	11.74 ***	-51.09 *	-51.09	-2.29
Spain	-31.36 ***	12.02 ***	-9.22 ***	11.30
Denmark	-43.66 ***	-30.62 ***	-51.86 ***	-46.31 ***
Sweden	-51.10 ***	-51.83 ***	-51.83 ***	-7.54
Switzerland	-39.11 ***	-35.09 ***	-35.09 ***	358.00 ***
United States	-61.36 ***	-59.58 ***	-59.58 ***	-70.73 ***
Cyprus	--	-20.26 ***	--	--
Czech Republic	--	-30.41 ***	-10.15	--
Estonia	--	-28.06 ***	-7.79	--
Hungary	--	-32.59 ***	-12.33 *	--
Latvia	--	-61.35 ***	-41.09 ***	--
Lithuania	--	-64.71 ***	-44.45 ***	--
Malta	--	89.51 ***	109.78 ***	--
Poland	--	-53.14 ***	-32.87 ***	--
Slovakia	--	-44.69 ***	-24.42 ***	--
Slovenia	--	-60.85 ***	-40.59 ***	--
2000	5.54	7.49 **	6.13 *	9.64
2001	9.21 **	11.17 ***	10.82 ***	15.37
2002	10.30 ***	13.53 ***	15.00 ***	20.99 *
2003	8.43 **	12.02 ***	17.99 ***	34.29 ***
2000*euro	1.81	-0.41	--	0.97
2001*euro	4.02	1.67	--	-2.94
2002*euro	8.59	5.55	--	6.35
2003*euro	14.23 ***	14.71 **	--	-6.51
2000*nms	--	--	3.39	--
2001*nms	--	--	2.63	--
2002*nms	--	--	1.43	--
2003*nms	--	--	-2.01	--
euro	-30.91 ***	-25.55 ***		-35.94 **
nms	--	--	-21.35 ***	--
constant	80.82 ***	73.66 ***	72.51 ***	62.24 ***
No. Obs.	89	140	140	88
Adjusted R-squared	0.93	0.92	0.92	0.95

Note: ***/**/* denote significance at 1% / 5% / 10% level
The coefficients of the individual country dummy variables show differences in banking internazionalization, in columns 1,3 and 4 with respect to the UK and Austria, in column 2 with respect to the UK and Cyprus.

duction of the Euro, Euro zone countries are concentrating the flows of funds sent abroad in other Euro zone countries (from 30.8% in 2000 to 35.3% in 2003, simple average) while almost maintaining them in the rest of EU-15 countries (at least, in weighted averages), or even decreasing in other developed countries and in emerging countries. However, regarding the group of emerging countries, only the relative weight of funds sent to emerging countries in Europe and, in particular, to New Member States, has increased.

When we consider the foreign assets sent abroad by EU banks, some of the former developments are less clear cut. In general, the increasing importance of foreign assets in New Member States banking systems declines since other emerging markets seem to be attracting funds from European banks (Table 6, Panel B). Finally, when we add all the developed countries, the weight of total foreign assets in New Member States is much lower although it still shows an increasing trend (Table 6, Panel C).

The tentative conclusion has to be that NMS become relative more attractive to foreign banks within the group of emerging countries as the expectations that they will join the European Union consolidate over time and they are finally fulfilled.

Statistical significance of the observed trends towards an increase in internationalization and openness

The last step in this examination of the trends in inflows and outflows of banking assets is to test for the statistically significance of the observed trends over time. Since internationalization of banking activity can be a global phenomena the trends in the flows among Euro zone countries can just be part of a general trend in internationalization. The methodology used to isolate the Euro effect is a simple linear regression where the dependent variable is the outflow (inflow) of bank assets divided by the country GDP of the country every year from 1999 to 2003, and the explanatory variables are time and country dummies, together with a cross effect that allows for differences in the coefficients of the time dummies of the Euro countries over time. The analysis will account too for possible differences with NMS. In particular, we define a Euro dummy variable (i.e. 1 if the country is member of the European Monetary Union, 0 other-

wise), and a MNS dummy variable (i.e. 1 if the country is a NMS, 0 otherwise) that multiply the time dummies so their respective estimated coefficients will determine differences of Euro (NMS) relative to the rest of the world. The results of the regression estimation are presented in Table 7.

The analysis shows that the Euro Area attracts banking assets at a higher increasing rate than the rate of other developed countries (column 1). The inclusion of New Member States does not change the former conclusion regarding received foreign claims (column 2). However, column 3 shows that there is not a statistically significant effect for NMS and the increasing trend observed in the flows they received must be considered in the context of a global trend of openness among the countries considered.

When explaining the banking assets sent abroad by the banks in a country the effect is not statistically significant. As it will be confirmed later on, this is evidence of some asymmetries in the flows received and sent across countries[12].

4. DETERMINANTS OF BANKING INTEGRATION

4.1. Some tentative hypothesis about determinants of banking integration

Even if trade and monetary barriers are levied, economic integration may not be a natural phenomena as account has to be taken of the incentives of the economic agents to go abroad, of the institutional conditions of the countries of origin and reception in terms for example of property rights protection and, specially in the case of banking markets, the influence of regulation. Moreover, these factors may play a different role to explain integration in terms of assets sent abroad than in terms of assets received. This section presents some tentative hypothesis on factors that can explain the differences observed in the inflows and outflows of banking assets in the process of internationalization[13]. Next we will provide some

12. Using disaggregated Spanish data we have investigated to what extend the trends in banking integration concentrate in interbank money market flows. Although the interbank market is the most integrated, the general conclusion about a steady trend in integration for the rest of the products remains unchanged.

evidence on how such hypotheses are consistent or not with the empirical data.

Efficiency and competition considerations

The **size** of the country explains differences in the level of trade. Large domestic markets allow domestic firms to grow within the country boundaries even in sectors where scale economies are important. Domestic firms in small countries, on the other hand, will have to go abroad to gain scale and lower costs producing higher level of output. In general, trade, imports and exports, represents a larger share of the GDP in small countries than in large countries. In the present context of banking integration a reasonable assumption is that large countries will also have relatively larger domestic banking markets and therefore the proportion of foreign banking assets in the country will be lower than in small ones. On the other hand, all the rest equal it could be expected that small countries will send relatively more banking assets abroad than large ones.

In a competitive market, the market share of the firms is determined by their respective level of competitiveness. Within Europe, some countries have more bank oriented financial systems while other countries have more capital markets oriented ones. Presumably more "**bancarised**" countries will have a comparative advantage to send banking assets abroad, while it will be more difficult to countries with less expertise in banking to gain market share in the countries with highly efficient banking systems. Under these assumptions it is expected that the share of foreign banking assets will be lower in countries with higher "bancarisation", while this variable will be positively associated with the proportion of banking assets sent abroad.

Another important premise of the theory of **competition** is that markets where incumbent firms earn extraordinary profits attract new entrants, while exit of competitors is more likely in more competitive markets than in less competitive ones[14]. Moreover, a very competitive national banking system might act as a barrier to entry of foreign competitors. If the banking system witnesses strong competition among national incumbents, the prospects for foreign new entrants are bleak. However, on the other hand, extraordinary prof-

13. For a more general approach to the determinants of international bank flows, within the conceptual framework of trade gravity models see Papaioannou (2005).

14. See Tirole (1988) and Freixas and Rochet (1997) for a detailed discussion of this issue and for further references.

its can last longer if the incumbents build effective barriers to entry (i.e. a dense network of branches, close bank-customer relationships, and high switching costs as a result of convenience and proximity, and so on).

Banks in more competitive domestic markets might seek international expansion in order to increase efficiency (more assets with similar costs as in cross border lending) or to diversify their loan portfolio in order to gain room for more risk taking and, thus, increase profitability[15], which is more in line with local activities carried out through subsidiaries. On the other hand, to expand abroad might be highly demanding in terms of funds needed to enter into the foreign market (i.e. before the bank acquires a critical mass it must be prepared to sustain losses or, if it buys a foreign bank in difficulties it will be necessary to invest significant amounts of money). Thus, it might be that less competition at home helps international expansion.

So, the impact of competition (or lack of it) in banking integration might be the opposite depending at which side of the coin we are looking at although the final impact is, in both cases, an open question that should be tested empirically. In this paper the structure of the national banking market will be approximated by the Herfindahl index of concentration. For a given number of firms, a higher value of the index implies more opportunities for collusion among incumbent firms and, thus, less competition. But very often concentration is endogenous and in markets with sunk costs higher competition derives into more concentration, Sutton (1991). The interpretation of the empirical results will have to account for these alternative meanings of the concentration variable.

Preferences, regulations and rule of law[16]

Ownership structure of banks might have also an impact on the incentives and capabilities of local banks to expand abroad or in terms of attraction to foreign banks. State owned banks might have more difficulties in being accepted abroad or less incentive to expand.

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15. Hughes et al (1996) find evidence that more geographically diversified banks do not have lower non-performing ratios. Thus, the benefits of geographical diversification are spent away in more risk taking activities (by sector, borrowers or whatever) that bring about higher expected profits.

16. A growing literature emphasizes the relevance of the institutional framework in order to understand financial development and, in particular banking sector developments. See, for instance, Barth et al (2001) and La Porta et al (2002).

On the other hand, since state owned banks have, at most, no competitive advantage regarding privately owned banks, foreign banks might see an opportunity to expand their activities. Family owned banks might be less interested in foreign expansion since, usually, that would mean more demanding capital requirements and, sooner than latter, equity issues that will dilute ownership and control of the bank. On the contrary, a widely held bank (i.e. one which has no shareholder in the position to control the bank) might have more incentives (including expense theory or agency arguments) to expand abroad and more capabilities since they can tap equity markets easily (i.e. managers have less binding constraints). On the other hand, a banking system were widely held banks are prevalent could be more friendly to foreign banks that one where family or state banks dominate the landscape.

At some point in time **banking regulators** may be more or less prone to allow their national banks to enter other banking markets or, probably more relevant, more or less reluctant to allow foreign banks entering the local market. Prudential concerns might be a reason to restrict international expansion. Some regulators, those less independent of the government, might be interested in protecting national banks from foreign competition, either in order to favor the development of "national champions" that can play a leading role in European markets or to protect vested interest of local banks. The less independent the higher the probability of interfering in market forces leading to integration of banking markets.

The legal system has a well known effect on the development of financial systems and economic growth. Papaioannou (2005) provides recent evidence in this topic for international bank flows. It might be the case that banking systems pertaining to countries with **high standards in terms of law** enforcement, accounting standards, judiciary efficiency, shareholder protection and business ethics attracted more international banks than those in the opposite side.

4.2. Empirical analysis

The impact, if any, of the former elements is an empirical question that can be tested with the available data. The empirical model to be

estimated in order to test the theoretical predictions outlined above will be formulated as follows:

$$I(i)_{ct} = C + \alpha_1 SIZE_{ct} + \alpha_2 BANCAR_{ct} + \alpha_3 HERF_{ct} + \alpha_4 WIDE_c + \alpha_5 INDEP_c + \alpha_6 RULE_{ct} + \varepsilon_{ct}$$

As previously explained, *I(1)* represents the total banking inflow of assets received by the country over total banking assets of the country banking system, while *I(2)* is the total banking assets sent outside the country, over total banking assets of the country. The actual values of these variables are presented in Table 8.

The variable *SIZE* is used to account for the relative size of the country and it is measured by the GDP of country c in year t over the sum of all GDP in year t for the countries in the sample. The variable *BANCAR* is equal to the ratio between total banking assets of the country c in year t and the country and year GDP; it measures the relative importance of banks in the financial system of the country. Variable *HERF* is the Herfindahl index of concentration of the bank assets of country c in period t, calculated from raw data published by ECB (2003b). The variable *WIDE* expresses to what extent the ownership of the banks of country c is concentrated or dispersed, where higher values of the variable imply higher dispersion of ownership; the actual values of the variable are taken from Caprio et al (2003). *INDEP*, also from Caprio et al (2003) is the degree of independence of the banking supervisor from the Government. The variable *RULE*, from La Porta et al (1998), is again a categorical variable that provides an assessment of the law and order tradition in the country.

The empirical model will include time period dummies to evaluate the trend of integration within the period under study taking into account the other explanatory variables of the model. It can be applied across Euro zone, EU and developed countries. However, since there is no easily available information on banking structure variables outside the EU[17] and we are mainly concerned about integration across European banking markets and the impact of Euro, we focus on the two first areas. In particular, expanding the regressions from Euro zone countries to EU countries we are able to test if the Euro has had a positive impact on banking integration by introducing into the model the variable EURO that takes the value of 1 if the

17. Moreover, we could also take into account flows towards emerging markets (although there is no data of inflows from those countries to developed countries) in general or across several regions (i.e. Central and Eastern European Countries or Latin American countries).

Table 8.
Summary Statistics

Panel A: Euro Area

	No. Obs.	Mean	Std. Desv.	Min	Max
SIZE	40	10.00	9.96	1.46	32.27
BANCAR	40	2.47	0.73	0.98	3.70
HERF	40	9.23	6.45	1.00	22.00
WIDE	36	0.28	0.31	0.00	1.00
INDEP	36	2.89	1.21	1.00	4.00
RULE	40	9.03	0.83	7.80	10.00

Panel B: European Union

	No. Obs.	Mean	Std. Desv.	Min	Max
SIZE	52	7.69	7.60	1.13	25.04
BANCAR	52	2.51	0.73	0.98	4.00
HERF	52	9.75	6.67	1.00	22.00
WIDE	48	0.30	0.32	0.00	1.00
INDEP	48	2.83	1.23	1.00	4.00
RULE	52	9.15	0.82	7.80	10.00

SIZE: GDP of country c in year t over the sum of GDP in year t for the countries in our sample. GDP is obtained from OCDE.

BANCAR: Total banking assets of country c in year t divided by each country GDP. ECB (2003b)

HERF: Herfindhal index of concentration of the bank assets of country c in period t. ECB (2003b)

WIDE: Degree of dispersion of ownership of the banks of each country. The variable is calculated for a sample of the ten largest traded banks in terms of total assets at the end of December 2001. Caprio et al (2003)

INDEP: Degree of independence of the banking supervisor from the Government. The variable is based on a survey conducted between 1998 and 2000. Caprio et al (2003)

RULE: Assessment of law and order tradition in the country. It is an average from 1982 to 1995. La Porta et al (1998)

country belongs to the Euro zone and zero otherwise. If the coefficient of the EURO variable is positive, it means that a single currency enhances banking integration.

When the model is estimated for the sample of EU countries, the explanatory variables include also the dummy variable UK that takes the value of 1 if the observation corresponds to the United Kingdom and 0 otherwise. This variable controls for the fact that United Kingdom has a highly differentiated market-oriented financial system, compared with the rest of the countries of the sample.

The following results should be taken with caution since the number of observations is quite limited (around 40 country-year for Euro

zone and 52 for EU). We have focused on the significant variables only in order to increase degrees of freedom. Despite that, adjusted R^2 are not very high, in particular for the outflows model. Certainly, the estimation results are a preliminary exploration of trends and explanatory variables. Nevertheless, taking into account the former important caveat, some preliminary conclusions arise which might be useful in shaping policy recommendations.

Euro zone

Table 9, first column, shows that size of the country is negatively correlated with the proportion of foreign banking assets in the country, and evidence that may be parallel to the observed fact that smaller countries are more open to foreign trade and investment. Secondly, countries more bank-oriented receive less foreign banking assets confirming that more efficient national banking systems attract less foreign competitors. Also, countries with more concentrated banking

Table 9.
OLS estimates of the determinants of 'Total Foreign Claims' Received as % of Total Banking Assets

	Euro area		European Union	
Variable	**Coefficient**	**P-Value**	**Coefficient**	**P-Value**
SIZE	-0.99	0.000	-1.26	0.000
BANCAR	-9.16	0.020	-8.93	0.000
HERF	-1.11	0.004	-0.65	0.015
WIDE	10.64	0.034	19.60	0.000
INDEP	5.27	0.014	3.73	0.003
RULE	5.58	0.011	7.61	0.000
EURO	--	--	9.30	0.000
UK	--	--	13.20	0.000
2000	3.14	0.091	3.24	0.025
2001	5.58	0.011	5.56	0.001
2002	6.68	0.003	6.85	0.000
CONS	-34.18	0.101	-42.27	0.008
No. Obs.	36		48	
Adj R-squared	0.68		0.78	

The P-value provides, directly, the level of significance of the parameter.

systems are less attractive for foreign banks, than countries otherwise (the variable Herfindahl is negatively associated with bank assets received). That might be an indirect evidence of the existence of effective barriers to entry into national banking markets. A banking system with banks not in the hands of few shareholders but, instead, widely held seems to be more contestable to foreign banks. Supervisory dependence of the government and lack of rule of law are strong entry barriers for foreign banks. Moreover, time dummies significantly register a growing trend in terms of penetration of banking systems by foreign banks in the Euro area. The hypothesis on determinant of inflows of banking assets are in general confirmed by the data and within the economic and institutional environment of the different countries the introduction of the Euro has a positive and significant effect in increasing the flows of banking assets over time.

Table 10 refers to the determinants of outflows of banking assets. The variables INDEP and RULE are excluded as explanatory variables since they are not relevant to explain sending banking assets. As it was expected, the signs of the coefficients of the rest of economic and institutional variables are just the opposite as those of Table 9 which shows the determinants of receiving banking assets. Larger and

Table 10.
OLS estimates of the determinants of 'Total Foreign Claims' Sent as % of Total Banking Assets

	Euro area		European Union	
Variable	**Coefficient**	**P-Value**	**Coefficient**	**P-Value**
SIZE	0.25	0.000	0.46	0.000
BANCAR	2.92	0.001	2.33	0.035
HERF	0.37	0.004	1.12	0.000
WIDE	-5.20	0.030	5.54	0.075
EURO	--	--	4.93	0.007
UK	--	--	-7.16	0.031
2000	-0.09	0.949	2.26	0.174
2001	-1.30	0.369	0.57	0.732
2002	0.83	0.576	1.37	0.425
CONS	-4.09	0.148	-13.21	0.002
No. Obs.	35		47	
Adj R-squared	0.45		0.60	

The P-value provides, directly, the level of significance of the parameter.

more "bancarised" countries allow for larger banks in the domestic market and larger banks have more tangible and intangible assets to expand internationally. Apparently, more concentrated national markets facilitate the accumulation of slack resources, and more profits, that make easier the expansion abroad. The evidence would be consistent with the hypothesis that intense competition forces bank concentration, and surviving banks are in better conditions to expand to foreign markets, but this conclusion should be validated from larger and more representative data. The time dummies show coefficients with an increasing trend but they are not statistically significant.

European Union-15

Table 9 and 10, second columns, shows the results of estimating the former two equations to the whole EU countries. It can be seen that all the variables keep their signs and level of statistical significance, with the exception of WIDE in the estimation of outflows for the Euro area countries only (Table 10)[18]. Therefore, the main conclusions above for the case of the EMU alone are basically confirmed, including the increasing time trend. In fact, when an interactive variable is defined in terms of TIME and EURO, the estimated coefficients corresponding to assets received are positive and significant, while the coefficient for the TIME dummies are not significant[19]. This clearly indicates that Euro countries are in a positive trend of integration while in the other three, Sweden, Denmark and UK the trend is not detected.

Both, the EURO dummy and the UK dummy variables show coefficients positive and statistically significant in Table 9. This means that countries in the Euro zone receive more bank assets on average than non Euro area countries. However, on average for the period, the coefficient for UK shows that this country is more open to foreign banks than the Euro zone, although the gap is closing as the positive trend in the TIME x EURO variable shows.

In a similar vein, second column of Table 10 shows that bank outflows are positively affected by the Euro since the coefficient of

18. We do not have an explanation for this change in sign for the estimated coefficient of WIDE.

19. Not reported here. The reader interested can ask the corresponding author for those regression results.

the variable EURO is now positive but the coefficient of the variable UK is negative and statistically significant. On average, UK, Denmark and Sweden hold less banking assets in other EU countries than countries in the Euro zone, on average. The coefficients of the interactive variable TIME x EURO (not reported) also show an increasing trend for the Euro area.

Unfortunately, lack of data from NMS prevent us from quantifying the determinants of openness of their banking systems. In any case, as mentioned in section 3, the fact that foreign ownership of banks is quite high in many of those countries is a new factor that should be considered.

From our previous analysis it can be observed that there is a certain degree of asymmetries between the flows received and the flows sent across countries. In particular, the impact of the Euro appears to be higher in the banking assets received. Table 6 offers a possible explanation for this question. It seems to be the case that, since the introduction of the Euro, the level of flows sent by Euro zone countries has not experienced a significant increase. However, those countries may have reorganized the structure of their portfolios, increasing, as Table 6 shows, the relative importance of other Euro zone countries.

5. POLICY DISCUSSION

Several issues arise from the former descriptive and econometric results. Banking integration across European countries, in terms of foreign banking assets, is low. Given the increasing evidence of high integration of interbank and, to a lesser extend, of wholesale banking markets, that result points towards the lack of integration of retail banking markets. If that is the result of remaining cross border country barriers (i.e. differences in taxation, regulation, idiosyncrasy) or, on the contrary, is the natural result of an activity that, mainly, could be considered non-tradable, in the sense that relationship banking for non-financial firms and high switching costs (enhanced by proximity services provided by dense branch networks) for households lead, naturally, to a low level of integration in terms of retail banking activities and, more generally, in terms of foreign banking assets, deserves further attention. However, the fact that the level of international activity across countries seems to respond to institutional as well as competitive and technical factors opens new ways to promote poli-

cies that would enhance integration such as regulatory independence at each country level, together with more open forms of bank ownership.

More difficult recommendations can be made with regard to competitive conditions in national countries. On the one hand, there appears to be efficiency gains from absolute and relative size of the national banks that may explain why larger and more concentrated banking systems send more assets abroad, but at the same time the possibility that such structure of national champions be the result of strategic national barriers that contribute to perpetuate national concentration and higher profits is also a possibility. In any case, the point is that bank concentration can result from efficiency reasons in a competitive environment, and can not be considered *per se* evidence of lack of competition (i.e. more efficient banks take over less efficient ones with an increase in concentration as a result).

The second result is that Euro seems to enhance banking integration. That might be the result of interbank assets but also the higher willingness of banks to explore new country markets trying to carve out a niche in specialized lending to households or non-financial firms. In terms of medium term strategies it could be also a way to take positions in foreign markets in order to be ready for future mergers and acquisitions. Some large Spanish, Dutch or German banks are buying small specialized lending firms or developing branch activities based on new technologies. This practice explains some of the asymmetries observed in the flows across countries, in the sense that all countries send assets abroad in amounts proportional to their respective sizes, but in terms of receiving assets small countries receive proportionally more than large ones.

Regarding New Member States, in general, they have a larger degree of openness that some EU-15 banking markets. The expectations about joining the EU, already materialized, as well as expectations about joining the EMU, might have triggered across European banks an increasing interest in being present in their banking markets. At the same time, historical and geographical reasons (i.e. proximity) or particular strategies of some large European banks are some of the driving forces behind the higher and increasing openness of these countries.

Some academics sustain that banking trends in Europe pointed towards the need for a unified banking supervisor, in particular, in the Euro zone but, probably, outside the European Central Bank[20]. If

we take into account the actual low level, albeit increasing along time, of foreign banking assets across European countries, a cooperative solution among supervisors seems more appropriate, at least for the time being. That cooperative approach is in fact the one that prevails now in Europe through the Banking Supervision Committee (BSC) of the ECB and through the recently level 3 Committee of the European Banking Supervisors.

Despite the limited data availability, the line of research that is opened with this paper seems promising, in particular regarding the integration of NMS banking systems and the integration of European banks in other areas such as non-European developed countries and also emerging countries outside Europe.

6. CONCLUSIONS

The paper studies the evolution and determinants of banking integration across European countries with particular attention to the impact that the Euro might have had on that process. Our work merges two particularly fruitful strands of economic literature: financial integration and the role of institutional factors for financial development.

It is the first time that banking integration is being studied using quantitative indicators coming from banking consolidated data from the BIS. Previous work has focused mainly on price indicators, branches and subsidiaries or M&A activity. Not until very recently have started to appear measures of integration based on flows of quantities of loans and deposits. The scant papers that have used Euro area quantitative banking indicators are based on statistics designed mainly for monetary policy analysis or is obtained from non consolidated balance sheets, and, thus, has some inherent biases.

The paper contains some country by country indicators of internationalisation of national banks as well as of openness of national banking systems. The analysis of the former indicators shows a growing trend towards both, internationalisation and openness of banking systems, in particular, in Euro area countries. Moreover, we provide evidence on the higher and increasing across time openness of countries that have been in the process of adjusting economic and finan-

20. Danthine et al (1999) and EEAG (2003).

cial institutions to become members of the European Union, a process that just ended a few months ago.

The second new contribution of this paper is to investigate empirically the determinants of the degree of internationalisation and openness of country banking systems. We find that the size, the degree of "bancarisation" and the concentration of the banking system have opposite effects in terms of outflow and inflow of banking assets. The larger the country or the more bancarised or the higher the level of concentration in the national banking market, the lower the penetration of banking assets from abroad. At the same time these factors are positively associated with the amount of banking assets that are sent abroad that is with the level of internationalisation of the national banks. Moreover, the institutional framework has an impact on the openness of national banking systems. In particular the rules of law, the independence of the supervisor, and the absence of a dominant shareholder among banks have a positive impact for attracting foreign banks interest.

Once we control for the determinants of foreign banking assets allocation, we focus our analysis on the role that the Euro and the single market promoted by the European Union might have had until now in order to spur banking integration in Europe. We find a significant and positive impact of the Euro although with some asymmetries in the evolution of flows send abroad and flows received. Thus, banking integration seems to proceed at a highest speed among Euro area countries than in EU or developed countries as a whole. Moreover, the impact of the Euro on financial integration is not of once for all but, on the contrary, more distributed along time.

Although the trend towards more banking integration, in particular in Euro area countries, seems quite steady, it is true that the level of banking integration is still at a low level. Therefore, some concerns, mainly in the academic world, about the urgent need of a unique European banking supervisor are premature. The response given by European supervisors through increased co-ordination around the European Central Bank (through its Banking Supervision Committee) or, more recently, around the CEBS (Committee of European Banking Supervisors) seem more in line with market developments in the European banking sector, at least for the time being.

Finally, the results of the analysis indicate that the New Member States that joined the European Union in May 2004 show similar level of banking integration in terms of inflows of banking assets

received than the existing member states, especially those of the Euro zone. Within the enlarged Union no unbalance exists in the level of banking integration between old and new members so no special developments should be expected for the near future. The reason of this balanced situation is that banking integration has been taking place steadily in the past with many banks, especially from neighboring countries, buying privatized banks of the countries waiting for joining the European Union.

ANNEX:

Table 1A
"Total Foreign Claims" as percentage of GDP of each country

Panel A: Total foreign claims received/sent from/to the Euro Area

	Received					Sent				
	1999	2000	2001	2002	2003	1999	2000	2001	2002	2003
Austria	29.32	35.60	68.26	62.90	60.80	14.81	19.45	10.51	11.46	13.81
Belgium	44.27	43.73	48.93	68.73	68.01	79.12	87.32	100.64	109.87	110.98
Finland	14.51	17.84	17.12	15.65	15.12	5.82	6.60	4.26	3.98	2.85
France	14.35	16.52	16.04	17.78	18.87	21.09	18.68	18.57	23.36	23.77
Germany	11.65	10.79	10.84	16.22	17.17	22.32	27.21	32.26	31.90	33.55
Ireland	71.91	74.51	79.16	86.10	105.64	7.53	10.21	11.56		
Italy	24.12	25.74	25.74	26.99	27.03	6.72	8.27	7.81	9.20	8.12
Netherlands	46.18	53.80	56.03	59.80	65.22	33.70	33.39	34.19	73.66	86.28
Portugal	37.32	55.54	58.15	66.79	71.40	13.85	10.60	11.22	14.90	21.96
Spain	17.36	19.83	20.05	25.18	27.46	13.29	16.53	16.27	17.49	19.46
Weighted average	20.34	22.35	23.94	27.93	29.47	20.34	22.35	23.94	28.46	30.04
Simple average	31.10	35.39	40.03	44.61	47.67	21.82	23.83	24.73	32.87	35.64

Panel B: Total foreign claims received/sent from/to the EU-15

	Received					Sent				
	1999	2000	2001	2002	2003	1999	2000	2001	2002	2003
Austria	32.51	39.09	71.91	66.48	64.27	20.46	26.98	13.56	14.61	18.05
Belgium	51.24	50.70	55.37	77.34	80.15	104.81	115.44	130.32	152.04	149.31
Finland	23.92	30.92	28.80	26.57	19.50	15.26	21.53	27.10	24.31	21.86
France	16.92	22.79	22.07	23.61	26.01	28.23	25.90	26.23	31.33	34.80
Germany	13.88	15.83	15.95	19.88	22.15	36.86	47.71	59.50	58.70	57.27
Ireland	92.50	97.37	106.57	117.19	151.62	48.47	56.87	57.94		
Italy	26.66	29.80	29.60	31.55	31.92	10.92	12.43	11.82	13.73	11.68
Netherlands	51.24	60.53	63.53	69.90	78.58	48.22	55.17	53.77	105.03	119.66
Portugal	40.76	60.09	64.55	74.98	108.71	19.29	16.17	17.77	19.81	29.97
Spain	20.14	22.97	23.30	29.63	33.33	16.43	21.07	20.66	22.27	23.48
Denmark	23.69	32.47	40.14	45.26	32.80	16.17	20.75	19.25	21.33	27.33
Sweden	23.56	27.25	31.37	29.69	27.93	19.35	38.91	39.24	28.94	62.25
UK	42.64	50.59	58.71	59.598	62.59	12.87	18.81	19.86	21.91	24.77
Weighted average	26.89	32.16	35.16	38.56	41.21	26.89	32.16	35.16	39.13	41.82
Simple average	35.36	41.57	47.07	51.67	56.89	30.56	36.75	38.23	42.83	48.62

Sources: Total Foreign Claims from BIS (http://www.bis.org/statistics/consstats.htm) and **CDP from OECD** (Main Economic Indicators.)

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Comments

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Daniel Pérez, Vicente Salas Fumás, and Jesús Saurina have written a fascinating paper addressing an extremely important topic. They are the first to use a detailed BIS data set to examine changes the cross-border flow of funds among banks over the past 5 years. Their work is very much at the center of the debate over the impact of monetary union on financial markets and institutions in Europe. The conclusion I draw from the paper is that there is clear evidence of an increase in financial flows among Euro Area countries, suggesting that monetary union has indeed furthered the integration of financial markets in Europe.

It is worth starting with a reminder of why everyone promotes financial integration. Briefly, a bigger and more integrated financial system will be one with lower transactions costs and a more efficient allocation of capital. Cross-border competition and consolidation should create scale economies that reduce the costs of individual financial transactions and diminish the information problem problems that plague virtually all banking and financial system transactions.Furthermore, by reducing barriers to international capital flows, financial integration will improve investment project selection and allow for better diversification.

While everyone might agree that financial integration is a good thing, it is harder to find agreement over how to measure it. I will adopt the following definition for the purpose of this discussion: Financial integration means that liabilities generated in one physical location can be used to purchase assets or issue loans in another. That is, integration eliminates the geographic correlation between the sources and uses of bank funds.

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At this point, an American example might help. Consider someone obtaining a home mortgage loan in Boston. The person will almost surely call a mortgage broker who will then survey available financing terms. The funds that are loaned in Boston might come from Chicago, San Francisco, or Dallas. In the end, no one really knows, and it makes no difference.

The Pérez et. al paper is empirical, so my task is to figure out what to think of their results. Do they find evidence for increased financial integration in Europe precipitated by monetary union? The short answer is maybe.

Let's take a look at their data to see why. Their Table 1A, panel A, reports the quantity of cross-border flows received by Euro-Area banks from cross-border Euro-Area sources (what the authors refer to as openness) and the flows sent by Euro-Area banks to other Euro-Area banks (internationalization). Table 2 reports the quantity of cross-border flows received by Euro-Area banks from all developed country sources, as well as those sent by Euro-Area banks to all country destinations. To evaluate whether monetary union is responsible for the increases, we need to compare the change in flows to and from Euro-Area sources with those from to and non-Euro-Area sources. That is, we should compare Table 1A, panel A, with (Table 2 minus Table 1A, panel A).

To address the question of interest, I regress the flows sent and received on a country fixed effect and a time trend. That is, the data from the tables is y_{it} in the following regression:

$$y_{it} = \theta_i + \gamma t + \varepsilon_{it}$$

where θ_i is a country fixed effect, t is a time trend, and ε_{it} is an error term. The results of this regression are reported in Table 1.

The results show that (1) the flows into Euro Area banks from Euro Area sources increased, and they did it more quickly that the flows from non-Euro Area sources; and (2) the flows out of Euro Area banks increased equally to Euro Area and other destinations. This verifies Pérez et. al's conclusions about the increases in flows.

The authors go on to ask whether these increases are the consequence of growth in the interbank market. I agree with there conclusion that this is unlikely, and the reason is that the inflows increased by much more than the outflows. Interbank flows create outgoing assets that are equal to incoming liabilities all within the Euro Area. This is not what we see. Instead we see banks issuing liabilities out-

Table 1:
Is it Euro-Area Integration?

Assets from	Received	Sent
Euro Area Sources	4.23	3.08
	(6.35)	(3.46)
Non-Euro Area Sources	2.27	3.92
	(4.36)	(2.87)
Difference	1.96	-0.83
	(3.00)	(1.12)

The table reports the coefficient on the time trend in a regression of assets relative to GDP, including country fixed effects:
They measure the annual average annual increase in the percent of GDP.
Numbers in parentheses are t-ratios that are robust to heteroskedasticity.

side their countries and using these to finance the acquisition of domestic assets.

Another possible cause of increased financial flows is more international diversification by banks. This could be true, especially since the biggest countries show the smallest changes.[1] But if the explanation doesn't work for the big countries, it isn't a very good explanation. Another reason to doubt that diversification is driving the increase flows is that business cycles are much more synchronized in the Euro Area than they were before monetary union, possibly as a consequence of monetary union itself.

Returning to the data, a second way to address the question of financial integration is to look at the analog to the savings/investment correlations. If geography has become unimportant for finance, then there should be low correlation between the cross-border inflows and outflows of funds. Looking again at Pérez et. al table 1A, panel A, we can ask whether the correlation of the "Received" and "Sent" has gone down, as integration would predict. Alas, the answer is no. Taking out Ireland, because some of its data is missing, we have 9 countries to measure correlations each year. The result is that the correlation went from 0.60 in 1999 to 0.57 in 2003 – not what we would hope to see. (And the opposite of what people find using the national income accounts saving and investment data.)

1. Looking at the same data in either Tables 1A, panel A, and 2, it is easy to show that the larger the country, the smaller the increase in flows between 1999 and 2003.

Finally, as the authors note the financial flows they find are really quite small – less than half of what they are in the U.K. Why is this? One explanation comes from noticing that there have been only a handful of cross-border bank mergers. While the number of chartered banks in the U.S. has decline by 10 percent, mostly as a consequence of interstate mergers, there has been exactly one cross-border European bank merger. This seems like strong evidence against integration.

Regulatory monopoly is a possible explanation for the lack of European cross-border bank consolidation. Allows mergers would reduce the power of national bank regulators and supervisors, even eliminating some of their jobs entirely. If this is true, then we will not see true financial integration in the Euro Area until we see a single authority regulating and supervising banks in the entire Eurosystem (or EU). While the competition authority may care about an Italian bank buying a Spanish one, the EU FSA would not.

Even though I am convinced that Pérez et. al have established that financial flows have increased in the Euro Area since 1999, I would go on to argue that the European financial markets and institutions will not be truly integrated until there is legal harmonization across the region. While depositors may not worry, this is a serious issue for lenders. Bankers will only provide funds to borrowers if there is a reasonable chance they can get the money back. This means that they must have authority to repossess collateral.

While there are differences across U.S. states in the rights accorded lenders, they are modest when compared with the divergence in legal structures within the euro area. A single example will suffice to make the point. In Germany, France and the U.K., following a mortgage default, it takes between 11 and 15 months on average to repossess the home that was used as collateral. In Italy, repossession takes an average of 48 months – four times as long. These legal difficulties extend into the corporate sector as well. As a result, Italian financial markets are substantially smaller than those in nearly every other European country.

The trend toward consolidation of European market trading, exemplified most recently by the proposed link between London and Frankfurt, is really beside the point. What is important is not where the shares or bonds are exchanged, but the laws governing the management of the firm should they fail to perform adequately, and the physical location of the collateral that would need to be seized. Firms

can be identical in all respects, but if they operate in different countries they are likely to choose to finance their activities in very different ways.

Until corporate legal structures are harmonized, and enforcement of the new laws is equally effective across countries, there will be substantial differences in financial markets. Only when holders of the lenders making loans to Italians, Germans, French and Dutch borrowers all have the same rights will financial markets become equally important across all of the countries in Europe.

Comments

Guillermo de la Dehesa,
Chairman of the CEPR, Centre for Economic Policy Research

I am very pleased to discuss this interesting paper, by Pérez, Salas and Saurina, because it provides an excellent guide to the determinants of banking integration in Europe (or the lack of it) and because it uses new cross-border consolidated banking assets data from the BIS to better contrast their empirical evidence.

One of the main paradoxes of European banking integration is that it has advanced more rapidly in the US and the UK than in the Euro Area, when we all thought that the introduction of the euro was going to accelerate banking integration and consolidation. Today, of the top 10 world banks by market capitalization, there is only one, Santander, as number 9, from the Euro Area, while there are five from the US, three from the UK and one from Switzerland. The top three banks: Citigroup, Bank of America and HSBC have a total market cap of around 500 $ billion, followed closely by J.P Morgan and Wells Fargo which make another $ 300 billion approximately. Then there is another group of 3 banks: Royal Bank of Scotland, UBS and Wachovia, with a combined value of around $ 250 million and the last two are Santander and Barclays with another $110 billion approximately, that is, a total value of the ten of around $910 billion. The main reason for Santander being in the top 10 because it has been able to buy a large UK bank: Abbey National, acquisition that it would have been almost unthinkable in the Euro Area.

I start from the premise that the only way to accelerate retail banking consolidation in the Euro Area is through mergers and acquisitions. The Euro Area is already highly bank developed and there is almost no scope for any bank to grow and have a significant presence through opening branches and subsidiaries, except by buying other domestic retail banks. But, unfortunately, one of the major impediments to integrate banks in the Euro Area, which is not mentioned in the paper, is that many of the Euro Area banks are not

quoted companies or they do not have their equity represented by shares, and therefore, cannot be bought or sold. In Spain, more than 50 per cent of the banking market is in the hands of non equity and non public saving and cooperative banks. In France, more than 40 per cent of the market is also represented by non quoted banks. In Italy, most banks are public and quoted, but the end result is the same, given that they are controlled by regional or provincial foundations, which want their banks to help the development of their regions and are not ready to sell and lose the control of such important financial instruments. In Germany, Deutsche Bank which is one of the most important wholesale European banks, only holds 5.5 per cent of the total retail domestic banking market, where the Länder Banks, the saving banks and the cooperative banks take by far the largest market share.

In my view, this is the main reason why, controlling for other determinants such as the defensive attitude by some regulators, the "national champion" attitude by some governments and the deceit of the takeover Directive, there has been so little retail banking consolidation in the Euro Area through M&A. The few cross-border mergers or takeovers in the Euro Area, in the last five years have been: HSBC buying Credit Commercial de France, the consolidation of some Nordic banks (the Finish Merita, the Swedish Nordbanken and the Danish Unidanmark and Christiania) into "Nordea"; Santander's acquisition of Totta and part of Champalimaud's group in Portugal and of Abbey in the UK; the BBVA recent acquisition of Banca Nationale dei Lavoro, or the three banking consolidations operated in the Benelux: the merger of ING with Brussels-Lambert and BHF; of Fortis group with Mees Pierson and of KBC.

By contrast, the domestic mergers and acquisitions have been very large: BNP buying Paribas, Santander merging with Central Hispano, BBV merging with Argentaria, the consolidation of some Italian Banks into new groups such as Unicredito, IMI-San Paolo, Intesa or Capitalia, the merger of Allianz with Dresdner in Germany, the mergers of ABN with Amro and of NMB Postbank with National Netherlanden in the Netherlands and of Fortis with Generale Bank in Belgium and of BCP with Portugues do Atlantico, Mello and Pinto Sotto Mayor in Portugal.

This is also the reason why Euro Area retail banks, which are sitting on a large excess of capital to make acquisitions, have turned mainly towards America for their expansion because it is easier to buy

than in Europe: some in North America like Deutsche, BNP and ABN-Amro, and some in Latin America, like Santander, BBVA and ABN-Amro. Their only expansion of Euro Area retail banks in Europe has been, on the one side, in the New Member countries by German, Italian and Austrian banks, because of their banking privatizations and their future adherence to the euro, and, on the other side, within the Euro Area but almost exclusively in "mono-line consumer financing", like the cases of Santander, BNP and Societé Generale.

Another determinant not mentioned in the paper is the different banking trends in the US and Europe. In the US, there is an increasing specialization through "monolines" such as mortgages, consumer finance, credit cards etc, because, first American consumers prefer unbundled products, second, because it is a more integrated and homogeneous financial market, where it is easier to exploit economies of scale, and, finally, because markets are more fragmented. By contrast, in the Euro Area, the trend is still more towards universal banking and agglomeration of financial services, bank-assurance, pensions and even investment banking. The main reasons for that differential trend are that banking retail distribution is much more important and extensive than in the US; that consumers like to get all the financial products from one banking branch and that governments are, in general, favoring national champions to compete with US banks.

I am not against the formation of national champions in banking provided they are the result of a "market based" approach, such as in the UK, in the Netherlands or in Spain. What I do not like is the idea of the "government induced" to national champions, as it has happened in France, with the attempt of merging BNP, Paribas and Societé Generale, through AXA, or the acquisition of Credit Lyonnais by Credit Agricole, a cooperative bank, instead of allowing Barclays to buy it, or in Germany, with the failed attempt of the merging Deutsche, Dresdner and Allianz, with the German Chancellor recently talking about merging Deutsche, Dresdner and Commerz, or finally, in Italy with the government talking about a merge of Unicredito and IMI-San Paolo.

The main conclusion of the lack of further cross-border retail banking consolidation in the Euro Area is that, without it, the probability of competing world-wide with US banks is going to be mean. The top five US banks have around 80 per cent market share in their

total domestic market, a large platform that allows them to make higher profits and to accumulate higher market value to be able to expand abroad, while the top five Euro Area banks have around 30 per cent of market share in the Euro Area total domestic market, which is still much more fragmented, and the economies of scale and scope are lower, so is their absolute volume of capital to expand. If Euro Area banks cannot expand cross-border in the Euro Area, they may eventually been bought, some of them, by US banks. This has already been the case for US investment banks in Europe.

Finally, I would like to make some future suggestions to the authors of the paper. The first one is that it may be useful to try to develop a "gravity model" similar to the one used in international trade to study the cross-border consolidated banking flows in the Euro Area. Second, it will be also interesting to see if the New Member countries are going to increase these cross-border consolidated flows once they are sure to adopt the euro as a currency or even from the time when they adopt a currency board or a hard peg with the euro, to see if the euro is going to play a bigger role in the future banking integration in the expanded Euro Area. Third, Italian banks seem to have a much larger penetration in New Member countries than what the flows show, both Unicredito, Intesa, IMI-San Paolo and even BNL are well established there. Finally, a short comment it looks as if the authors view that increasing the independence of Central Banks is going to help the banking integration trend may have been already refuted by the recent case of Italy.

DISCUSSION

Jordi Gual raises the question of the direction of causality in the regressions, because in the paper it is imposed and not formally tested. He also mentions the need to take into account more detailed measures of the set of determinants preventing integration. In particular the role of regulators (not only their level of formal independence from governments), the rule of law (including consumer protection issues which may cause mortgage market segmentation) and fiscal differences among countries (which may induce tax discrimination)

Jose Garcia Solanes says that banking services are not tradable and therefore the main way to internationalization is by mergers and acquisitions. He points out that there are another ways of financial integration besides banking integration. For instance rates of return are converging in the EU and that may be interpreted as a symptom of financial integration.

Isaac Tower says that the high share of foreign investment in Eastern European banks is explained by historical circumstances: the old banks from the communist era where bankrupt and were rescued by foreign investors.

Guillermo de la Dehesa asks the authors to look in the new member states at the influence of currency board or Euro-pegging on their level of the banking integration. He is surprised by the low level of banking integration in the found by the authors in the Nordic countries.

Vicente Salas thanks the comments. He agrees with the discussants that it is difficult to find a generally accepted standard to judge the extent of banking integration, and mentions the influence of Internet in creating an integrated market and the difficulties in measure its influence. He justifies their election of quantity flows as a measure of banking integration as a first step in that direction. He also realizes it is very difficult to isolate the effect of the Euro on banking integration. It is important to notice that, given the economic attractiveness of Euro area, Banks from outside the Euro area find more interesting to invest in European banks, and this should increase competition. Finally he acknowledges that banking integration should be included in the general framework of financial integration.

Exchange rate regimes for the New Member States of the European Union*

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Abstract

This paper combines theoretical and empirical analysis to derive the desirable exchange rate regimes for eight of the New Member States of the EU in their initial steps towards EMU. The theoretical model takes into account the size of the internal market distortions and technological gaps of these countries, and assumes forward-looking behaviour of both firms and households. In the empirical part, we calculate numerical values for the incumbent parameters and estimate SVAR models in order to extract variances and covariances between shocks to these economies and to the euro area, which are necessary to compute individual social losses and derive the optimal regimes. The main result is that the choice varies depending on the institutional and structural features of each economy, and on the likely source and nature of economic shocks to which it is exposed.

1. Introduction

After joining the EU in May 2004, the New Member States (NMS hereafter) are free to choose their exchange rate system under very general principles of monetary policy coordination established by

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the Maastricht Treaty[1]. The only requirement clearly specified is that, prior to joining the "euro club", the candidates must stay in the ERM2 for a period of at least two years. The candidate countries are very little restricted in a) the time of entry into the ERM2, b) the period staying in the system and c) the exchange rate arrangement during the whole process. This paper tries to determine the optimal exchange rate arrangement for the NMS countries in their initial steps towards EMU[2].

Some recent contributions have analysed the pros and cons of several exchange rate options for the NMS without backing the analysis with an economic model. Not surprisingly, the authors reach different conclusions and make distinct (and to some extent contradictory) propositions. For instance, Buiter and Grafe (2002) examine the pros and cons of different strategies and conclude that EMU membership should be as early as possible for each country, even at the cost of derogating the Maastricht requirements[3]. Gros and Hobza (2003) arrive at a similar conclusion after verifying that the variability of the real exchange rate of these countries has been surprisingly low during the last years. In contrast to this precise prescription for a rapid and irrevocable monetary union, Schnabl (2002) simply advises to widen as much as possible the group of countries that use the euro as the central standard in the exchange rate policy and in the external transactions. However, in this informal euro club, exchange rate adjustments would be allowed to accommodate differences in national productivity growth and other real shocks. The idea that exchange rate strategies by the NMS should be related to structural and institutional conditions in these countries, was already stated by Corker, Beaumont, van Elkan and Iakova (2000), Szapáry (2000), Backé and Wójcik (2002), and Backé et al (2004).

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1. The Maastricht Treaty contains only two references to exchange rate arrangements, based on the principles of monetary cooperation and mutual surveillance: a) the exchange rate mechanism of any country in the EU is a matter of common interest, and b) exchange rate stabilisation, that is, avoiding realignments, is one of the convergence criteria in the process of European monetary unification, and is required to countries that participate in the ERM2.

2. Participation in the EMU process is compulsory for all member states, and has to be differentiated from the EMU itself, or the adoption of the euro, which is the natural end for those countries that comply with the Maastricht criteria.

3. According to these authors, the NMS countries are very vulnerable to financial crisis if they remain outside the euro, by the fact that their capital markets are small and liberalised.

Ca'Zorzi and De Santis (2003) is, to our knowledge, the first theoretical approach to this issue, but with a different focus in methodology and goal. The authors use a simple Barro and Gordon (1983) model, in the line of the time inconsistency literature, to derive the implications of several exchange rate arrangements for the inflation rate of both the accession countries and the euro members, along the different phases leading to EMU.

The main purpose of this paper is to investigate the appropriate exchange rate regimes for the NMS, at the beginning of the post-accession era, using theoretical and empirical analysis. On the theoretical side, we use a model that specifies conveniently the differences in the countries' economic structures. In our opinion, this is a necessary feature because the Central and Eastern European countries that have acceded to the EU are progressing at different speeds towards a market economy and still exhibit important differences in trade and economic structures. As will be seen below, these structural national differences are reflected in the variety of exchange rate arrangements currently adopted by the NMS. On the empirical side, for each country we compute the social losses corresponding to the three exchange rate arrangements considered in the analysis, in order to derive the optimal solution. As these calculations require statistical information about the external shocks that hit each country and the euro zone, we previously estimate structural VARs to extract the necessary values of variances and covariances of shocks in the whole extended area (except for Lithuania and Malta for reasons of data availability).

Our model builds on Gerlach and Smets (2000), Svensson (2000) and Detken and Gaspar (2003). The main differences with these approaches are that we incorporate market distortions that generate inflation bias, and adapt the model to three different exchange rate regimes. Furthermore, we take into account a deterministic variation of the real exchange rate of the NMS countries vis-à-vis the euro area in order to capture Balassa-Samuelson effects created by the catching-up process.

Our interest is not to explore the economic fundamentals of a wide list of exchange rate systems, as the one provided by the IMF for instance[4]. Rogoff et al (2003) do this task for the whole IMF members, and Papaioannou (2003) adopts a similar scope for six Central American countries. We concentrate, instead, on a small set of exchange rate arrangements, those that are especially suited

for the EMU process: a) flexible exchange rate coupled with inflation targeting in the monetary policy, b) ERM2 with limited flexibility in the exchange rate and a targeted inflation rate, and c) currency board with respect to the euro. The first one is valid for the pre-Maastricht phase in which NMS countries have still not joined the ERM2, and permits using monetary and exchange rate policies with more autonomy to adjust the economy. The second one is the system envisaged by the European Commission for countries that are in the Maastricht stage and make efforts to complain with the convergence criteria. The third one is compatible with both phases but, given that their rules are stricter than those of the ERM2, we will assume that the countries deciding to adopt the currency board with respect to the euro also want to participate in the Masstricht phase[5].

The rest of the paper is organised as follows: section 2 describes the exchange rate regime developments in the NMS since the beginning of the 1990s; in section 3 we set the model and solve it for each of the three exchange rate regimes. In section 4 we estimate structu-ral VARs to extract the nature and statistical moments of external shocks to each NMS and to the euro area as a whole. In section 5 we present calculations of social losses and derive the appropriate exchange rate regime for each country. Finally, section 6 provides the main conclusions and derives policy prescriptions.

2. RECENT EXCHANGE RATE DEVELOPEMENTS IN ACCESION COUNTRIES

Table 1 displays the evolution of the exchange rate systems in the ten NMS countries since the year in which they put in motion their transformation process towards market economies. The

4. See the compilation of the de facto exchange rate regimes of the IMF members in International Monetary Fund (2003).

5. As regulated by the Amsterdam Council Resolution of June 1997, ERM2 requires a central parity with the euro agreed with the euro countries, and two ± 15% bands around this parity. However, cohabitation in the ERM2 is permitted with a fairly broad range of exchange rate arrangements. The exchange rate regimes that are clearly excluded are: parities not mutually agreed, crawling pegs, and pegs to currencies different from the euro.

table refers to the "de jure" exchange rate arrangements classified in several issues of the "International Financial Statistics" of the IMF. For the particular case of the NMS, this ranking also corresponds to the "de facto" regimes carried out by their authorities[6]. Although there is no uniform trend, which would characterise this evolution, there are four features deserving special comments.

First, exchange rate regimes vary widely across countries. Since the beginning of the period, one can find all kinds of arrangements, from currency boards to independent floats. Second, changes in exchange rate strategy may be grouped in several different evolutions. On the one hand, Poland, Hungary, the Czech Republic and Slovakia have moved towards greater exchange rate flexibility. These four countries organise their monetary policy around a more or less explicit inflation target strategy. On the other hand, Latvia and Lithuania followed the converse way by drastically replacing independent floats for strong pegs since 1994[7]. Finally, Estonia, Malta and Slovenia have maintained their initial exchange rate arrangements, which are, respectively, : currency board linked to a strong European currency[8], peg against a composed basket (including the sterling pound, the US dollar and the euro[9]), and managed float keeping the currency within crawling bands around the euro[10]. Cyprus may also be included in the last group, although with a change towards increasing flexibility in January 2001. On that date, Cyprus widened its horizontal bands around the euro from ± 2,25% to ± 15%. As a result of all these changes, the general picture emerging in the NMS countries, at the eve of their integration in the EU, looked like corner solutions: five independent or managed floats and five peg arrangements.

6. See the "de facto" ranking reported in International Monetary Fund (2003)

7. Latvia has de facto pegged to the SDR since February 1994, but this arrangement was not officially formalised until 1997. The current weight of the euro in the SDR is 35%. Lithuania pegged its currency to the US dollar until February 2002. Since then, the reference currency has been replaced by the euro.

8. Estonia pegged its currency to the Deutsche mark until mid-June 2001. Since that date, the reference is the euro.

9. The weight of the euro in this basket is 70%.

10. Before January 1, 1999, the reference currency was the Deutsch mark.

Table 1:
Exchange rate regimes in accession countries

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Cyprus	3	3	3	3	3	3	3	3	3	3	4	4	4
Czech R.	3	3	3	3	3	6	7	7	7	7	8	8	8
Estonia	na	2	2	2	2	2	2	2	2	2	2	2	2
Hungary	3	3	3	3	6	6	6	6	6	6	7	7	7
Latvia	na	8	8	3	3	3	3	3	3	3	3	3	3
Lithuania	na	8	8	2	2	2	2	2	2	2	2	2	2
Malta	3	3	3	3	3	3	3	3	3	3	3	3	3
Poland	5	5	5	5	6	6	6	6	6	8	8	8	8
Slovakia	3	3	3	3	3	6	6	7	7	7	7	7	7
Slovenia	na	7	7	7	7	7	7	7	7	7	7	7	7

IMF Exchange Rate Regime Classification:
1. Dollarization or Euroization: no separate legal tender
2. Currency Board: currency fully backed by foreign exchange reserves
3. Conventional Fixed Pegs: Peg to another currency or currency basket within a band of at most ± 1%
4. Horizontal Bands: Pegs with bands larger than ± 1%
5. Crawling Pegs: Pegs with central parity periodically adjusted
6. Crawling Bands: Crawling pegs combined with bands of more than ± 1%
7. Managed Float with no Pre-announced Exchange Rate Path: Active intervention without precommitment
   Independent Float: Market-determined exchange rate and monetary policy independent of e. r. policy

Source: International Monetary Fund (2003) and IMF, "International Financial Statistics", several issues.

Third, the NMS joined the EU with almost full liberalisation of capital movements. This represents an important difference with respect to the situation of Greece, Portugal and Spain in the moment of their accession to the EU, and has important consequences for exchange rate policies. On the one hand, the liberalisation of the capital account lays the basis for quicker adjustments in the exchange rate to its long run equilibrium value, which increases the viability of floating regimes[11]. On the other hand, it also exacerbates the variability of exchange rates in the short term, and makes the possibility of (disruptive) speculative attacks more likely.

Forth, since accession itself does not have any immediate implications for the choice of exchange rate regime, each NMS has maintained its own system. Consequently, the general diversity in

11. Bulír (2004) shows empirically that the depth and degree of liberalisation in the capital markets of the Czech Republic, Hungary, Poland and the Slovak Republic is positively related to the speed of adjustment of the exchange rates of these countries. This author demonstrates that the speed of adjustment of the Czech koruna and, more recently, the Hungary forint are gradually becoming comparable to that of the G-7 countries.

exchange rate arrangements is still present at the beginning of the post accession era.

3. Output, inflation and social losses

Our theoretical approach builds on Gerlach and Smets (2000), Svensson (2000) Detken and Gaspar (2003), adapting the main framework to take into account the rigidities and the technological gap in the markets of the NMS, and the possibility of different exchange rate regimes.

3.1. Flexible exchange rate regime.

The model is composed of the following equations:

$$L = \frac{1}{2} E_t \left\{ \sum_{j=0}^{\infty} \beta^j \left[\pi_{t+j}^2 + \lambda \left(y_{t+j} - k \right)^2 \right] \right\} \tag{1}$$

$$\pi_t = \alpha y_t + \beta E_t \pi_{t+1} + \varepsilon_t \tag{2}$$

$$y_t = -\varphi \left[i_t - E_t \pi_{t+1} \right] + E_t y_{t+1} + \delta \left(s_t - p_t \right) + d_t \tag{3}$$

$$i_t = E_t s_{t+1} - s_t + \tau_t \tag{4}$$

Equation (1) is a standard central bank's intertemporal loss function that penalises deviations of inflation and output gap from their targets. The inflation differential, π_t, is defined with respect to the socially desired rate, while the (log of) output gap, y_t, is calculated with respect to the long run or potential level which is normalised to zero. The parameter k measures the extent to which market rigidities and technological gaps of the NMS influence domestic monetary policies. It is assumed that k is equal to zero in the euro countries. Rigidities are mainly concentrated in the labour markets, as reflected by the fact that the natural rate of unemployment increased during the late 1990s despite the rapid economic growth in each country[12].

12. Some symptoms of this phenomenon are, for instance, the fact that the share of long term unemployment is substantial, labour force participation is declining, and labour mobility across sectors and regions is very low. However, there are large differences across countries that warrant a distinct value of the parameter k for each NMS.

E_t is the rational expectations operator in period *t*, β is the discount factor and λ is the relative weight attached to output variability[13].

Equation (2) is the aggregate supply in the spirit of the New keynesian Phillips curve. It may be derived assuming, as in Calvo (1983), that firms maximise the difference between expected marginal revenue and unit costs, and that only a fraction of them is allowed to adjust prices each period. Equation (3) indicates that the aggregate demand depends negatively on the real interest rate and positively on both the real exchange rate and the output expected for the next period. The domestic price level, p_t, and the nominal exchange rate, s_t, are measured in logs. The latter is defined as the price in domestic currency of a unit of foreign currency. The foreign price level and the foreign nominal interest rates are normalised to zero. The expected output in the aggregate demand is due to consumption smoothing reasons by households that maximise an intertemporal utility function under budget restrictions[14]. Equations (2) and (3) contain stochastic shocks which are assumed stationary AR processes: $\varepsilon_t = \rho\varepsilon_{t-1} + \xi_t$ and $d_t = \vartheta d_{t-1} + \upsilon_t$, with $0 \le \rho \le 1$ and $0 \le \vartheta \le 1$. The supply shock is deemed to capture everything affecting marginal costs and/or changes in firms' productivity, and the demand shock represents shifts in autonomous private and public expenditures.

Equation (4) is the uncovered interest parity condition including a stochastic country risk premium, τ_t. The risk premium as well as ξ_t and υ_t are assumed uncorrelated i.i.d. variables.

Events develop as follows: the private agents form expectations on prices taking into account the information available at that time. Then the output and or demand shocks are realised, and the central bank utilises this information to set its monetary policy. It uses the interest rate as the policy instrument according to an optimal simple rule that can be obtained solving the model. Assuming that the central bank cannot commit to a state-contingent rule of the inflation rate, and consequently takes expectations as given, the first order condition is obtained by minimizing the loss function with respect to the output gap and the inflation rate, subject to the aggregate supply:

$$\underset{\pi_t, y_t}{Min}\, Z = \frac{1}{2} E_t \left\{ \sum_{j=0}^{\infty} \beta^j \left[\pi_{t+j}^2 + \lambda \left(y_{t+j} - k \right)^2 \right] \right\} + l\left(\pi_t - \alpha y_t - \beta \pi_{t+1} - \varepsilon_t \right)$$

13. This weight is related negatively to the aversion to inflation variability.

14. See, for instance, Fraga, Goldfajn and Minella (2003)

The result is:

$$y_t = \frac{-\alpha}{\lambda}\pi_t + k \tag{5}$$

Substituting this expression in (2) and solving by forward iterations, we obtain:

$$\pi_t = \frac{\lambda}{\lambda(1-\beta\rho)+\alpha^2}\varepsilon_t + \frac{\lambda}{\lambda(1-\beta)+\alpha^2}\alpha k \tag{6}$$

$$y_t = \frac{-\alpha}{\lambda(1-\beta\rho)+\alpha^2}\varepsilon_t + \frac{\lambda(1-\beta)}{\lambda(1-\beta)+\alpha^2}k \tag{7}$$

These expressions indicate that there are two kind of factors, supply shocks and market rigidities that, in the short run, push inflation and the output gap out off their long run levels. As times goes on, the impacts of the supply shock disappear progressively, but the tracks of market rigidities remain permanently in both variables. In this framework we can talk of both inflation and output biases. The inflation bias increases with the weight attached to output stabilisation in the loss function and decreases with the slope of the aggregate supply (α). The output bias is also influenced positively by the weight on output variability, and negatively by the slope of the aggregate supply.

The influence of market rigidities on output is a new result compared to what we know from the Barro and Gordon (1983) model and can be explained taking into account the forward-looking nature of firms. When an exogenous supply shock hits the economy, rational agents, who know how national authorities react, revise their expectations and forecast correctly the new inflation rate of the next period. However, since forward-looking agents discount their expected value with the factor β (lower than one), a new gap is created between the current and the presently valued rate of inflation, leading firms to increase output as required by equation (2). As can be easily verified, if no discount were applied to inflation expectations ($\beta = 1$), market rigidities would not create any output bias and the inflation bias would reach a higher level.

The short run equilibrium values of the nominal exchange rate and interest rate may be obtained introducing (6) and (7) in (3), and solving the model composed of the resulting equation and equation (4).

Given that the inflation rate given by (6) is probably too high compared to the rate of inflation prevailing in the euro countries, it

is useful to examine several methods proposed in the literature to reduce it. Because the central banks of the NMS have not gathered sufficient credibility so far to overcome the time-consistency problem of their announcements, we will refer only to solutions that are time consistent in the present stage of economic integration. These solutions provide (stable) optimal combinations (π_t, y_t) with lower or null inflation bias. Three ways have been suggested.

a) The first one consists of undertaking structural adjustments to reduce progressively the market distortions in the NMS. If these measures are successful and k tends to zero, market distortions, and the inflation bias created by them, disappear progressively (see formula (6)). However, this process requires a very long period of time because actions are slow, and also because the technological gap and market distortions, which are still present in the NMS, are important as a result of their old planned economy era. For this reason, the adjustments oriented towards this objective, in place in each NMS since the beginning of the 1990s, must be pursued with complementary actions.

b) The second solution is the Rogoff (1985) proposition, according to which the government should delegate the monetary policy to an independent central bank, and select a governor or board having lower output-stabilisation preferences than the society. In terms of our model, this means that the weight λ in the loss function of the central bank must be lower than the preferred by the society. As can be seen in (6), as λ lowers, both the inflation bias, and the inflationary impact of the supply shock go down. However, this solution has two problems. First, for certain values of the parameters, the central banker in the NMS should be much more inflation conservative than the Governor of the ECB. This feature is not easily believable. Second, from (7) it follows that with a lower value of λ the sensitivity of the output gap to domestic supply shocks increases, making output more volatile.

c) The third solution is inflation targeting. Svensson (1997) showed that the inflation bias may be eliminated by assigning the central bank a specific and explicit inflation target lower than the rate socially preferred. The problem may be solved as follows. Expression (5) was obtained assuming that the rate of inflation

socially preferred is zero. If the central bank receives the mandate to obtain a relatively low inflation differential π^b (instead of zero), the expression would be:

$$y_t = \frac{-\alpha}{\lambda}\left(\pi_t - \pi^b\right) + k \qquad (5')$$

Given that in the case where market distortions do not exist equation (5) would be $y_t = -\alpha\pi_t / \lambda$, it is clear from (5') that the appropriate value for π^b to obtain the latter expression is[15]:

$$\pi^b = \frac{-\lambda}{\alpha} k,$$

The inflation gap that is now in the loss function is ($\pi_{t+j} + \lambda k/\alpha$).

Inflation targeting has the advantages of eliminating the inflation bias completely without increasing the variability of output. But it has the well known lack of credibility problem if the average inflation obtained (the socially preferred one) is systematically over the targeted rate. For this reason, we will assume that the authorities of countries adopting this exchange rate arrangement are less conservative and target an inflation rate that contains some inflation bias, which turns out to be a solution similar to the Rogoff (1985) proposition.

3.2. Floating within the bands of the ERM2, and inflation targeting.

There are two important conditions that countries must fulfil preceding the entry in the ERM2: a) their governments need to achieve a critical mass of fiscal consolidation and put in place a credible fiscal strategy in the medium term, and b) the central parity within the ERM2 must be carefully determined, under the multilateral setting foreseen in the ERM Resolution, in line with the underlying fundamentals of each country. If these conditions are met, the central parity will be credible and the whole system will work efficiently. We assume that the wide fluctuation bands around the central parity (±15%) offers a sufficient margin of manoeuvre to accommodate shocks and to preclude destabilising speculative attacks. The experience gathered from the former members of the ERM1 during the

15. Note that a negative value for π^b does not indicate that the targeted inflation rate is negative, but rather that it is lower than the rate preferred by the society.

period in which the system worked with the wider bands indicates that these assumptions are not unrealistic.

We share the opinion, repeatedly manifested by the EU Commission and the Euro system, that during the ERM2 phase a pre-announced rate of inflation is more credible than in other periods even though the target is not time-consistent. The reason is that the chosen rate is part of an institutional plan of rapid economic convergence with the euro countries, and the penalty that the authorities would pay in the case of non-fulfilment, is considered very high. In fact, we can assume that domestic authorities target an inflation rate, π^M, that is within the limit permitted (π_d percent over the inflation rate of the euro zone, π^f) by the Maastricht criteria:

$$\pi_t = \pi^M \leq (\pi^f + \pi_d) \tag{6'}$$

Introducing the inflation target in the aggregate supply (equation (2)), we obtain the output gap:

$$y_t = \frac{1-\beta}{\alpha}\pi^M - \frac{\varepsilon_t}{\alpha} \tag{7'}$$

From a dynamic point of view, and assuming that changes in the equilibrium level of the real exchange rate ($\hat{q}_t$) are given exogenously, the required (equilibrium) variation in the nominal rate is $\hat{s}_t = \pi^M - \pi^f + \hat{q}_t$ (a decrease in q_t indicates a real appreciation of the home currency). Given that both rates of inflation are exogenous as well, developments of the real exchange rate are an important determinant of the change in the equilibrium nominal exchange rate. For the reasons explained above, the catching-up process ($\hat{q}_t < 0$) will contribute to appreciate the NMS currencies. However, since the probability that the exchange rates reach the appreciating upper band of the ERM2 is small, we will assume that real appreciations are accommodated within the ERM2[16].

16. Available estimates on the magnitude of the Balassa and Samuelson effect in the Central and Eastern European countries, which is the main determinant of real currency appreciation in these economies, suggest that productivity-driven appreciations range between 0.1% and 1.6% a year, once the influence of other real factors that also affect the real exchange rate (RER) is excluded. See, for instance, Coricelli and Jazbec (2001), Égert (2002a,b) and Égert et al (2002). On the basis of similar findings, Kovács (2002) concluded that the real convergence of these countries should not endanger the fulfilment of the Maastricht criteria.

3.3. Currency board into the ERM2.

As explained above, this exchange rate regime is also compatible with the Maastricht criteria. The requirement to be satisfied is that the countries adopting this regime maintain the central (fixed) rate during at least two years before passing the convergence exam.

Under this system, the nominal exchange rate of the NMS with respect to the euro countries is fixed, that is, $s_t = \bar{s}$, and the interest rate differential equals the risk country premium, $i_t = \tau_t$. The relationship between the domestic and foreign rates of inflation may be explained as follows. Since $\hat{s} = 0$, the domestic and foreign equilibrium inflation rates are linked through the following relationship:

$$\pi_t = \pi_t^f - \hat{q}_t$$

This equation determines the domestic rate of inflation because both π_t^f and $\hat{q}_t$ are considered exogenous for each NMS country. We assume, indeed, that the variation of the real exchange rate is determined outside the model by real factors, among which Balassa-Samuelson effects are the most relevant, and that foreign inflation is also given because of the small country assumption that we apply to each NMS with respect to the euro area.

Therefore, using (6) with foreign parameters to determine, π_t^f and taking into account that for the euro countries $k = 0$, the current and expected inflation rates in NMS become equal to:

$$\pi_t = \frac{\lambda_f}{\lambda_f(1-\beta\rho)+\alpha_f^2}\varepsilon_t^f - \hat{q}_t \qquad (6")$$

$$E_t\pi_{t+1} = \frac{\lambda_f}{\lambda_f(1-\beta\rho)+\alpha_f^2}\rho\varepsilon_t^f - E_t\hat{q}_{t+1}$$

As can be seen, under a currency board, inflation in the NMS depends on both the impact of shocks affecting the euro zone and real exchange rate variations mainly determined by the catching-up process. Inflation no longer depends on shocks hitting the domestic country. This result agrees with the idea that in a pure currency board regime domestic authorities cannot use their monetary policy to stabilize the economy.

Combining the last two equations with the domestic aggregate supply, the output gap equation for the NMS becomes:

$$y_t = \frac{1}{\alpha}\left[\frac{\lambda_f(1-\rho\beta)}{\lambda_f(1-\rho\beta)+\alpha_f^2}\varepsilon_t^f + (\beta E_t\hat{q}_{t+1} - \hat{q}_t) - \varepsilon_t\right] \qquad (7")$$

It follows that the domestic output gap depends on both foreign and domestic supply shocks, and on the expected variation in the real exchange rate changes.

Note that if supply shocks are symmetric ($\varepsilon_t = \varepsilon_t^f$) and aggregate supplies have the same slope, i. e. $\alpha = \alpha_f$, the impact on inflation and output gap is the same as for the euro area, except for the variations introduced by real exchange rate developments. If supply shocks are only country-specific to NMS, inflation would not vary and the effects of those shocks on the domestic output gap would be equal to $1/\alpha$ times the size of the shock, ε_t (apart from influences coming from real exchange rate changes).

In sum, both domestic inflation rate and output gap have strong dependence on foreign shocks and real exchange rate developments. If the latter are strong enough, complying with the inflation criteria could be in danger.

Equation (4) determines the nominal interest rate:

$$i_t = \tau_t \tag{4'}$$

This is an additional proof that the central bank cannot use the monetary policy for stabilisation purposes. As a result, national authorities must use fiscal policy to obtain the equilibrium output gap. The appropriate fiscal measure, g_t^F, could be derived from (3) and (7") by inserting that variable as an additional demand factor, and making $s_t = \bar{s}$ in those relationships.

In order to compute the welfare effects for each case, we substitute the endogenous values of the inflation spread and the output gap corresponding to each exchange rate arrangement into the loss function (equation (1)). As can be seen, computation of social losses requires the estimation of a structural VAR to extract the nature of shocks and the values of their principal statistical moments. Given that in the VAR analysis residuals are white noise, our formulas must be adapted by assuming that supply shocks are i.i.d. disturbances. This implies that in the relevant formula, the autoregressive coefficient ρ equals zero. Furthermore, we assume that real exchange rate developments, mainly governed by the catching up process, follow an autoregressive mechanism. Taking into account this statistic property and computing for an infinite horizon as expressed by formula (1), for each exchange rate regime we obtain the following results:

Flexible exchange rate

$$L_t = \frac{A^2}{2(1-\beta)}\left(1+\frac{\alpha^2}{\lambda}\right)\sigma_\varepsilon^2 + \frac{1}{2(1-\beta)}\left\{B^2\alpha^2 + \lambda\left[B(1-\beta)-1\right]^2\right\}k^2 \tag{8}$$

$$A = \frac{\lambda}{\lambda+\alpha^2}, \qquad B = \frac{\lambda}{\lambda(1-\beta)+\alpha^2}$$

ERM2

$$L_t = \frac{\lambda}{2\alpha^2(1-\beta)}\sigma_\varepsilon^2 + \frac{\alpha^2+\lambda(1-\beta)^2}{2(1-\beta)\alpha^2}\left(\pi^M\right)^2 + \frac{\lambda}{2(1-\beta)}k^2 - \frac{\lambda}{\alpha}\pi^M k \tag{9}$$

Currency board arrangement

$$L_t = \frac{A_f\left(\alpha^2+\lambda\right)}{2\alpha^2(1-\beta)}\sigma_{\varepsilon^f}^2 + \frac{\lambda}{\alpha^2}\sigma_\varepsilon^2 - \frac{A_f\lambda}{\alpha^2(1-\beta)}\sigma_{\varepsilon,\varepsilon^f} + \frac{1+\lambda(1-\beta\mu)^2}{2\alpha^2\left(1-\beta\mu^2\right)}\hat{q}_t^2 + \frac{2\lambda k}{\alpha}\hat{q}_t + \frac{\lambda}{(1-\beta)}k^2$$

$$A_f = \frac{\lambda_f}{\lambda_f+\alpha_f^2} \tag{10}$$

Where f denotes the euro zone, $\hat{q}_t$ is the rate of real appreciation of the domestic currency, and μ is the autocorrelation coefficient of $\hat{q}_t$.

Equation (8) indicates that the social loss depends on the size (variance) of domestic supply shocks and on the magnitude of the internal market distortions. The flexible exchange rate arrangement shelters the country from foreign shocks and in principle it seems appropriate for economies that a) are hit by relatively small supply shocks with respect to foreign shocks, and b) have relatively small internal market distortions.

According to equation (9), domestic social loss depends on three factors: the inflation spread imposed by the Maastricht criteria, the variance of domestic supply shocks and internal market distortions. The last factor has much less influence than in each of the two other exchange rate arrangements. For this reason, ERM2 appears particularly suited to countries that have strong market rigidities and need to enhance the credibility of their monetary policy framework.

Equation (10) reveals that the variances of both shocks, domestic and foreign, influence the loss function. This is a natural result since the authorities that adopt this exchange rate regime cannot use monetary and exchange rate policies to smooth cyclical fluctuations. There are two additional features of this exchange rate arrangement that are worth noting. First, the covariance between domestic and foreign supply shocks has a negative impact on the domestic loss function. The direct implication is that the system is more desirable

if symmetric supply shocks are probable, whereas it poses a number of risks if asymmetric or country-specific supply shocks are thought to be likely. Secondly, for normal values of the aggregate supply slope, internal distortions (and/or a technological gap) have a lower impact on the social loss under a currency board than under a free float regime.

The preceding equations are complex enough to draw a rapid and simple diagnosis about the exchange rate system that suits better any given country. It seems clear, however, that the result depends on the structural features of the countries, such as the degree to which they are exposed to asymmetric shocks, the way the economy adjusts to those shocks, and the size of the inflation bias. The latter, in turn, depends on the importance of the internal distortions (k) and on the conservatism of the central banker (λ). In other words, there is no "one-case-fits-all" exchange rate regime that NMS should uniformly adopt in their run-up to the EMU membership. To obtain a definite diagnosis it is necessary to compute the expected loss under each type of exchange rate regime.

In order to make formulas (8) to (10) operative and compute social losses for each NMS, we need to estimate the variances and covariances of both domestic and foreign supply shocks, and assign values to the incumbent parameters. We undertake the first task in the next section, and leave the second one for section 5 of this paper.

4. REAL SHOCKS IN THE N.M.S. AND THE EURO ZONE

In this section we proceed to estimate a structural vector autoregressive model (SVAR) in order to extract demand and supply shocks in the euro zone and in NMS countries. For this purpose we follow the methodology of Bayoumi (1992) and Bayoumi and Eichengreen (1993a,b), which in turn is rooted in Blanchard and Quah (1989). The approach relies on the neoclassical synthesis model according to which a) a permanent expansionary shock in *demand* increases both the price and the output levels in the short run, but only the price level in the long run, and b) a positive shock in *supply* raises output and lower prices in both, the short and the long run.

During an initial step, we recover demand and supply shocks for both individual NMS countries and the euro area, as well as calculate correlation coefficients between them. In the second phase, we com-

pute impulse responses to unit demand and supply shocks, and look at the size and sign of their correlation coefficients. We use data for eight NMS: Czech Republic, Poland, Hungary, Cyprus, Slovak Republic, Slovenia, Latvia and Estonia. Lithuania and Malta are not included because the available set of data for these countries is not long enough.

In order to extract supply and demand shocks, consider, following the Bayoumi (1992) presentation, that the true aggregate supply and demand framework (AS-AD) can be represented as a vectorial moving average process of infinite order (*VMA(∞)*)

$$\begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix} = \sum_{i=0}^{\infty} L^i \begin{bmatrix} A_{11i} & A_{12i} \\ A_{21i} & A_{22i} \end{bmatrix} \begin{bmatrix} \varepsilon_{dt} \\ \varepsilon_{st} \end{bmatrix} \tag{11}$$

Where Δy_t, and Δp_t are the variations of (the log of) output and (the log of) price level, respectively; A_i are the matrices representing the impulse response functions of the shocks to the elements of the left hand vector in (11), and ε_{dt} and ε_{st} stand for demand and supply shocks, respectively. These shocks are supposed *iid N(0,σ)* and uncorrelated variables.

Taking into account the nature of the impacts that demand shocks have on output in the long run (their cumulative effects on Δy_t must be zero), it follows that

$$\sum_{i=0}^{\infty} A_{11i} = 0 \tag{12}$$

The model described by (11) and (12) can be estimated be means of a VAR where each element of the vector made of Δy_t, and Δp_t (symbolised by X) is regressed on lagged values of all of its elements. Denoting B the estimated values of these coefficients, our estimated equation is,

$$\begin{aligned} X_t &= B_1 X_{t-1} + B_2 X_{t-2} + B_3 X_{t-3} + \ldots + \ldots\ldots \eta_t = (I - B(L))^{-1} \eta_t \\ &= (I + B(L) + B(L)^2 + \ldots)\eta_t \\ &= \eta_t + D_1 \eta_{t-1} + D_1 \eta_{t-2} + D_3 \eta_{t-3} \ldots\ldots\ldots \end{aligned} \tag{13}$$

Where the error term η_t represents the residuals from the equations in the VAR. In the case of our AS-AD model, η_t is composed of the residuals obtained by regressing lagged values of Δy_t and Δp_t on current values of these variables. These residuals are labelled η_{1t} and η_{2t}, respectively.

To recover demand and supply shocks, ε_{dt} and ε_{st}, the residuals from the VAR, η_t, must be transformed into the demand and supply

shocks, with the aid of the following (2x2) C matrix, as follows: $\eta_t = C\varepsilon_t$.

In order to define the four elements of the matrix C, it is assumed that: Var(ε_{dt}) = Var(ε_{st}) = σ, and Cov($\varepsilon_{dt}, \varepsilon_{st}$) = 0. Taking into account these assumptions and the restriction (12), the matrix C is uniquely defined. As a result, in terms of the VAR representation we have

$$\sum_{i=0}^{\infty} \begin{bmatrix} D_{11i} & D_{12i} \\ D_{21i} & D_{22i} \end{bmatrix} \begin{bmatrix} C_{11i} & C_{12i} \\ C_{21i} & C_{22i} \end{bmatrix} = \begin{bmatrix} 0. \\ . \; . \end{bmatrix} \tag{14}$$

Note that, although the underlying theoretical model predicts specific responses of the price level depending on the nature of shocks, these responses are not imposed in the VAR and, for this reason, may be considered as an 'over-identifying' restriction. Fulfilment of this additional restriction will serve to validate our interpretation of the nature and effects of disturbances.

This methodology is applied to eight NMS and to the euro area as a whole. Since we want to concentrate on a period that is devoid of the structural effects inflicted by the transition process, our observed sample is relatively short. To overcome this difficulty and dispose of series long enough to estimate our SVAR, we use monthly observations starting in 1997:01 or in the first month after the date from which data is available. The seasonally adjusted Industrial Production Index (IPI) approximates the output variable, and the Harmonised Consumer Price Index (HCPI) is taken as the price index. Both data come from the *New Cronos data*-base of Eurostat, and the length of samples varies slightly from one country to another depending on the starting and ending months for which data was available. The sample periods are: Cyprus (1999:04-2003:10), Czech Republic (1998:03-2003:09), Estonia (1999:02-2003:10), Hungary (1998:02-2003:09), Latvia (1997:02-2003:10) Poland (1997:02-2003:09), Slovak Republic (1999:06 2003:10), Slovenia (1998:07-2003:10), and Euro Zone (1997:09-2003:10). The Akaike and the Schwartz Bayesian criteria were applied to derive the appropriate lag length of the variables. In the majority of our estimations the optimal length was eight months.

Figures 1 and 2, presented in the Appendix, depict the derived demand and supply shocks for the Euro area and for each of the NMS. The main descriptive statistics are reported in Table 2. As can be seen, there are noticeable differences among the countries. As far as demand

shocks are concerned, the smaller variances correspond to the euro zone, followed by the Czech Republic, Latvia, Poland and Cyprus, whereas the highest value corresponds to Hungary and Slovenia. With regards to supply shocks, which matter most for our analysis, the lowest values are found for Slovenia, the euro zone, the Czech Republic, Estonia and Poland, and the highest corresponds to Hungary.

A more accurate analysis of shocks similarities between countries can be carried out comparing correlation coefficients between individual NMS and the euro zone, for the same type of shock. Tables 3A and 3B show the results for demand and supply shocks respectively. Concerning demand shocks, most correlation coefficients of individual NMS indicate that shocks in these countries are not linked to the euro zone, given that the sign is negative; only the correlation coefficients of Poland (0.2412) and Cyprus (0.116) with the euro area have a positive sign. Regarding supply shocks, the correlation between NMS and the euro zone, presents a much better picture. The overall number of positive coefficients amounts to five, and the best figures are exhibited by Hungary (0.166), Slovenia (0.166), Estonia (0.140) and Poland (0.131). Nevertheless, three NMS countries, Latvia (-0.120), Cyprus (-0.087), and the Czech Republic (-0.086), demonstrate negative correlations with the euro area.

Table 2:
Descriptive statistics: demand and supply shocks

Demand Shocks

	Mean	*Variance*
EZ	0.0218	0.0174
Poland	0.0138	1.37
Czech Republic	0.0153	0.064
Latvia	0.0228	1.21
Cyprus	0.0158	1.61
Estonia	0.0188	2.62
Hungary	0.0158	6.76
Slovak Republic	0.0188	2.19
Slovenia	-0.0281	4.76

Supply Shocks

	Mean	*Variance*
EZ	-0.0264	0.308
Poland	-0.0895	0.676
Czech Republic	-0.0703	0.255
Latvia	-0.0288	1.18
Cyprus	0.076	1.04
Estonia	-0.0636	0.439
Hungary	0.0161	2.92
Slovak Republic	-0.0118	1.58
Slovenia	0.0268	0.132

These differences in behaviour between the two groups of the NMS mainly respond to internal structural factors and/or to the degree of economic integration with the euro zone. Thus, whereas Hungary and Estonia are well advanced in establishing a market

economy and restructuring their industrial sector– with the help of foreign ownership or participations- other countries of the second group, such as Latvia and the Czech Republic lay behind in the transition process[17]. Incomplete transition increases the risk of adverse supply shocks and magnifies the effects of shocks on the domestic economy. The negative correlation in supply shocks in the case of Cyprus with the Euro area may be explained by different reasons. For this small Mediterranean island, a less pronounced integration with the Euro zone, mainly due to geographical factors, is probably the

Table 3(A):
Correlation coeficients of demand shocks

	EZ	*Poland*	*Czech Republic*	*Latvia*	*Cyprus*	*Estonia*	*Hungary*	*Slovak Republic*	*Slovenia*
EZ	1	-	-	-	-	-	-	-	-
Poland	0.2412	1	-	-	-	-	-	-	-
Czech R.	-0.046	-0.272	1	-	-	-	-	-	-
Latvia	-0.005	0.220	-0.052	1	-	-	-	-	-
Cyprus	0.116	-0.029	0.075	-0.163	1	-	-	-	-
Estonia	-0.070	0.099	0.128	0.188	-0.145	1	-	-	-
Hungary	-0.011	0.101	0.089	-0.116	-0.160	-0.107	1	-	-
Slovak R.	-0.069	-0.057	-0.091	0.111	-0.080	-0.100	0.223	1	-
Slovenia	-0.041	0.107	-0.067	0.183	-0.012	-0.168	0.029	0.137	1

Table 3(B):
Correlation coeficients of supply shocks

	EZ	*Poland*	*Czech Republic*	*Latvia*	*Cyprus*	*Estonia*	*Hungary*	*Slovak Republic*	*Slovenia*
EZ	1	-	-	-	-	-	-	-	-
Poland	0.131	1	-	-	-	-	-	-	-
Czech R.	-0.086	-0.226	1	-	-	-	-	-	-
Latvia	-0.120	0.095	0.141	1	-	-	-	-	-
Cyprus	-0.087	-0.251	-0.144	0.041	1	-	-	-	-
Estonia	0.140	0.059	0.116	0.110	0.079	1	-	-	-
Hungary	0.166	0.302	-0.098	-0.095	-0.078	0.022	1	-	-
Slovak R.	0.067	-0.011	-0.1037	-0.180	0.087	-0.183	0.1524	1	-
Slovenia	0.166	0.171	-0.045	-0.109	0.120	0.085	0.205	0.065	1

17. The industrial sector in the Czech Republic has been affected by several banking crises along the ten last years.

18. The same ratios for Estonia and Latvia, which just precede Cyprus in trade integration with the euro area, are 2.32, 2.0, and 1.37, 2.0, respectively.

most relevant determinant. In fact, for the year 2003, exports of this country to the euro zone amount only to 0.21 per cent of total exports, and imports from this area hardly represent 2 per cent of total imports[18].

As far as the correlation coefficients among shocks identified within the group of NMS are concerned, some clusters may be discerned. With respect to the demand side, Slovenia exhibits ties with Latvia (0.183) and with the Slovak Republic (0.137). Regarding the supply side, Hungary has noticeable links with its neighbours, Slovenia (0.205) and Slovak Republic (0.152) and also with Poland (0.302),

Our results go in the same direction as previous findings, although with quantitatively lower correlation coefficients due the fact that our observations are monthly instead of quarterly. Using a similar VAR methodology with quarterly observations, Fidrmuc and Korhonen (2003) and Horvath (2000) also classified the NMS countries into two groups and the first, consisting of positive correlations, included Hungary, Estonia, Slovenia and Poland. Frenkel and Nikel (2002) and Süppel (2003) also found a very much alike classification, but including the Czech Republic in the first group[19]. Korhonen (2001) arrived at conclusions very similar to ours, using a structural VAR and monthly indicators of industrial production, but restricting his computations to correlation of impulse responses. Therefore, it seems that the general grouping of countries made according to shocks is well established in the empirical literature that use the VAR methodology.

Finally, Babetski, Boone and Maurel (2003) used a different methodology permitting to enlarge the sample and get an insight on the evolution of the coefficients. They computed time varying correlation coefficients and arrived at the conclusion that supply shocks do not seem to converge in the NMS countries with respect to the euro area.

When analysing the implications of shocks it is interesting to consider simultaneously their two main characteristics, symmetry and

19. The change in Frenkel and Nickel (2002) is probably due to a transcription error since within the two matrixes showing the results for correlation coefficients in that work (tables 2 and 3), the rows corresponding to the Czech Republic have exactly the same numbers (including signs) as those of Estonia. The result of Süppel (2003) might be, however, influenced by the fact that the number of (quarterly) observations (1996-I to 2002-II) in this study is excessively low for a reliable application of the VAR methodology. In any event, this author also concludes that output fluctuations in Poland, Slovenia and particularly Hungary, seem to be better aligned with those in the euro area than other NMS countries.

size. In Figure 3, shown in the Appendix, the value of this pair of variables is plot for supply shocks in each country. Size is measured along the vertical axis and correlation with the euro zone is represented along the horizontal axis. According to the partial information provided by this graph, which goes in the line of the theory of optimum currency areas, the countries better situated for currency unification with the euro area are, by this order, Slovenia, Estonia, Poland, Slovak Republic and Hungary.

To get a broader understanding of the consequences of shocks for the desired exchange rate system of a country or set of countries with respect to a more advanced economic area, it is important to investigate the way as different economies respond to the same type of shocks. If responses of output and prices, and/or their velocity of adjustment, are markedly different in each economy, even a symmetric shock may cause important disequilibria between countries and therefore call for flexibility in the exchange rate. For this reason it is important to analyse the dynamics of the adjustments in the NMS and in the euro area. To perform this analysis, we computed impulse-response functions for a positive one-unit demand and a positive one unit supply shock[20].

Tables 4A and 4B show the correlation coefficients of the output and price responses, respectively, to demand shocks in the NMS

Table 4(A):
Correlation coeficients of impulse response functions of output response to demand shocks

	EZ	*Poland*	*Czech Republic*	*Latvia*	*Cyprus*	*Estonia*	*Hungary*	*Slovak Republic*	*Slovenia*
EMU	1	-	-	-	-	-	-	-	-
Poland	0.0364	1	-	-	-	-	-	-	-
Czech R.	0.5671	0.6850	1	-	-	-	-	-	-
Latvia	0.2129	-0.2564	-0.3448	1	-	-	-	-	-
Cyprus	0.1999	0.5199	0.2328	0.3523	1	-	-	-	-
Estonia	0.1299	0.8169	0.6933	-0.1250	0.4845	1	-	-	-
Hungary	0.5047	0.5353	0.7174	-0.1692	0.4226	0.6559	1	-	-
Slovak R.	0.2417	0.6309	0.7829	-0.3499	0.3620	0.7127	0.6721	1	-
Slovenia	0.1471	0.8387	0.5588	0.1501	0.7090	0.8236	0.4725	0.6184	1

20. We do not offer the graphs of the Impulse-Response functions to save space. Our results satisfy the 'over-identifying' restriction and we observe a positive prices response to demand shocks and a negative prices response to supply shocks. These results are available upon request.

Table 4(B):
Correlation coeficients of impulse response functions of price response to demand shocks

	EZ	*Poland*	*Czech Republic*	*Latvia*	*Cyprus*	*Estonia*	*Hungary*	*Slovak Republic*	*Slovenia*
EMU	1	-	-	-	-	-	-	-	-
Poland	0.7776	1	-	-	-	-	-	-	-
Czech R.	0.8651	0.6084	1	-	-	-	-	-	-
Latvia	0.8567	0.9391	0.7144	1	-	-	-	-	-
Cyprus	0.4438	0.2278	0.7327	0.2882	1	-	-	-	-
Estonia	0.4328	0.5479	0.2249	0.5786	0.074	1	-	-	-
Hungary	0.7385	0.9161	0.6525	0.8732	0.2959	0.4609	1	-	-
Slovak R.	0.7212	0.8176	0.5850	0.8783	0.2290	0.6249	0.7873	1	-
Slovenia	0.4328	0.3857	0.2947	0.2727	0.1923	0.1633	0.2525	0.086	1

Table 5(A):
Correlation coeficients of impulse response functions of output response to supply shocks

	EZ	*Poland*	*Czech Republic*	*Latvia*	*Cyprus*	*Estonia*	*Hungary*	*Slovak Republic*	*Slovenia*
EMU	1	-	-	-	-	-	-	-	-
Poland	0.5556	1	-	-	-	-	-	-	-
Czech R.	0.5618	0.9743	1	-	-	-	-	-	-
Latvia	0.6467	0.9689	0.9192	1	-	-	-	-	-
Cyprus	-0.7956	-0.1922	-0.1707	-0.2979	1	-	-	-	-
Estonia	0.5163	0.9146	0.9703	0.8383	-0.1331	1	-	-	-
Hungary	0.5335	0.9422	0.9916	0.8727	-0.1190	0.9791	1	-	-
Slovak R.	0.5710	0.9803	0.9711	0.9541	-0.2116	0.9147	0.9431	1	-
Slovenia	0.5163	0.1735	0.1594	0.1752	-0.4535	0.1633	0.1314	0.1945	1

countries and the euro area. The calculations reveal that both output and price responses to demand disturbances are positively correlated between each NMS and the euro zone, with much higher coefficients in the responses of prices. Tables 5A and 5B provide the same calculations for supply shocks and reveal a marked difference in the case of Cyprus. In fact, this is the only country that exhibits a negative correlation with respect to the euro zone, probably as a result of its lower degree of economic integration with this area as argued above. The remaining seven countries show high synchronisation with the Euro zone in both types of responses. For output responses, the coefficients range between 0.51 (Estonia) and 0.65 (Latvia), and for price

Table 5(B):
Correlation coeficients of impulse response functions of price response to supply shocks

	EZ	*Poland*	*Czech Republic*	*Latvia*	*Cyprus*	*Estonia*	*Hungary*	*Slovak Republic*	*Slovenia*
EMU	1	-	-	-	-	-	-	-	-
Poland	0.9594	1	-	-	-	-	-	-	-
Czech R.	0.9092	0.5614	1	-	-	-	-	-	-
Latvia	0.9890	0.7419	0.2266	1	-	--	-	-	-
Cyprus	-0.2536	0.5416	0.1206	0.3206	1	-	-	-	-
Estonia	0.8101	0.2501	0.5504	-0.0400	0.0156	1	-	-	-
Hungary	0.8631	0.4914	0.4503	0.3986	0.2276	0.7077	1	-	-
Slovak R.	0.9608	0.2703	0.6323	0.033	0.093	0.6239	0.3202	1	-
Slovenia	0.8107	0.2501	0.5504	-0.0400	0.0156	1	0.7077	0.6239	1

responses the correlation is even stronger, going from 0.81 (Estonia and Slovenia) to 0.99 (Latvia).

Overall, the degree of synchronisation between the NMS and the Euro area in the dynamic responses to shocks is higher than that of shocks themselves, with the exception of Cyprus. The reason is that, in general, the more advanced economies in the transition process dispose of appropriate mechanisms facilitating dynamic adjustments.

5. SOCIAL LOSSES

In order to compute social losses for the each NMS country, and for each exchange rate arrangement, we assign here numerical values to the parameters, k_i, α_i, and λ_i. The calculus is carried out following the same procedure as Ca'Zorzi and De Santis (2003), and the results are reported in Table 6.

Our data are monthly, and come from *New Cronos* of Eurostat. Malta and Lithuania were excluded due to a lack of recent data. The period of analysis is not uniform across countries; it varies according to data availability, but in most cases ranges from 1997-01 till 2003-10. Therefore, it covers a phase that is devoid of the main transformations and structural reforms of the transition episode, which are not representative of the current situation. Taking averages over almost seven years gives a representation of the supposedly starting equilibrium values.

Table 6:
The baseline scenario

	q_i	*Rate of Output growth*	*Rate of Inflation*	k_i	*Inflation bias*	α=0.31 λ_i	α=0.62 λ_i	α=1.24 λ_i
Cyprus	-1.24	0.84	3.37	2.2	1.37	0.21	0.41	0.79
Czech Republic	-4.11	3.63	2.41	1.1	0.41	0.12	0.24	1.04
Estonia	-2.90	9.78	3.71	0.9	1.71	0.85	1.39	2.35
Hungary	-4.21	8.09	8.48	0.8	6.48	--	14.44	14.92
Latvia	-4.12	2.95	3.34	1.4	1.34	0.37	0.64	1.24
Poland	-3.72	5.09	7.17	1.4	5.17	2.83	3.26	5.38
Slovak Republic	-3.41	6.11	8.00	1.4	6.00	4.30	4.01	6.43
Slovenia	-1.12	2.06	7.24	0.9	5.24	29.59	6.80	9.44

The first column of Table 6 shows the average annual rate of real appreciation of the currency of each country with respect to the euro. We will assume that these rates reflect equilibrium changes responding not only (although mostly) to Balassa-Samuelson effect, but also to other real factors, such as industrial shifts between sectors. The expected real exchange-rate changes for the coming years are obtained by applying an autoregressive coefficient equal to 0.8 to the values of column 1, under the assumption that real exchange rate developments of these countries with respect to the euro area vanish as the catching up process goes ahead.

The second and third columns display the average output growth and inflation rate of the NMS over the indicated sample. We will consider that these two sets of values correspond to the initial equilibrium rate of potential output growth and inflation, respectively. The forth column shows the extent to which internal market distortions matter for monetary policy and is computed in the same manner as in Ca'Zorzi and De Santis (2003). Thus, we assume that this index may be approximated by one half of the gap between the rate of growth, which would bring about a rapid convergence with the euro area and the trend growth presented in column two. Also we define rapid growth as the rate necessary to catch up by 20 percent per capita GDP with respect to per capita GDP of the euro area in the next ten years[21].

21. This assumption implies that in the absence of distortions, the poorer countries would grow faster in order to achieve convergence in GDP per capita with the euro area, and consequently this is in accordance with the general statement of the β-convergence theory.

The fifth column shows the inflation bias obtained as the difference between the equilibrium inflation rate and the inflation rate that would prevail in the case of no distortions. We will assume that the latter is 2 percent for each NMS as well as for the euro zone.

In the sixth column we have computed the weight attached to output stabilisation (λ) for three possible slopes of the aggregate supply. Recent empirical studies for the euro zone point out that, for a horizon between two and three years after the shock it seems reasonable to assume that the slope of the aggregate supply is $\alpha = 1/1.6$, indicating that output is more responsive than prices along this horizon in the euro area[22]. Since no comparable evidence exists for the NMS, we decided -as Ca'Zorzi and De Santis (2003)- to conduct a sensitivity analysis by considering three alternative values for the aggregate supply slope: the same value as in the euro area ($\alpha = 0.62$), twice this value ($\alpha = 1.24$) and half ($\alpha = 0.31$). For each of these values, λ can be derived endogenously from the expression corresponding to the inflation bias in formula (6). Thus,

$$\lambda = \frac{I\alpha^2}{\alpha k - I(1-\beta)}$$, where I is the inflation bias.

For Estonia we have applied an alternative methodology to obtain the value of λ since the exchange rate regime of this country has been a currency board. In that case, we have computed the value of this parameter by taking the relative variance between output and inflation during the sample period.

According to the above expression, the larger the internal distortions, the more conservative (lower value of λ) the central banker needs to be to obtain a certain inflation rate. It also indicates that, all other things constant, higher inflation biases are associated with central bankers more concerned about stabilising output (higher value of λ). Thus, the very high values of λ in Hungary, Slovenia, Slovak Republic and Poland can be attributed partly to high levels of the inflation bias, and partly to the fact that real shocks affecting output have been extremely variable in these four countries[23].

In order to compute social losses for each NMS country and for

22. See Ca'Zorzi and De Santis (2003), p. 25, and the references cited there.

23. According to the values presented in Table 2, in Hungary the variance of demand and supply shocks have been 388 and 10 times the values registered in the euro zone, respectively. For Poland and the Slovak Republic, the ratios are (78, 2.2) and (126, 5), respectively.

each exchange rate regime, we introduce the values of parameters from table 3, and the values of variances and covariances of supply shocks obtained from our estimated structural VAR, into the formulas (8), (9) and (10). We assume $\alpha_f = 0.62$ $\lambda_f = 0.4$, in accordance to some recent estimates in the empirical literature, and = 0.98 in each country because this discount value is compatible with a real rate of interest equal to 2 percent. The last figure is reasonable given that at the end of 2003 the long term nominal interest rate in the NMS ranged between 5 and 6 percent, and the expected rate of inflation in those countries for the pre-Maastricht era probably lies between 3 and 4 percent. Finally, we assume that $\pi^M = 3$. This implies that the objective rate of inflation for the potential participants in the ERM2, during their last phase towards the EMU, is one percent over the rate targeted by the European Central Bank. The results are presented in Table 7 for the three slopes assigned to domestic aggregate supplies.

As can be seen, the results are robust to different values of aggregate supply slopes in each country. The optimal exchange rate arrangement appears very clear-cut for each country independently of the scenario assumed, except for Poland where the solution might be different for a very steep aggregate supply (scenario 3)[24]. We believe that the exchange rate arrangement that is assigned to each country in our numerical exercise may be rationalised by structural factors and economic considerations, even though some of these factors have not been explicitly taken into consideration in our model. Let us then give economic interpretation to our results.

There are three countries, the Czech Republic, Latvia and Cyprus, for which the best choice is a flexible exchange rate regime. For the Czech Republic, our analysis indicates that the solution is not related to any lack of credibility in its monetary policy. In fact, his rate of inflation has followed a pronounced downward trend since 1999, and now satisfies the Maastricht criterion. The inflation targeting strategy adopted in January 1998 has been very successful in this respect[25]. We believe that the economic problems lie instead in the real side of the economy. As explained above, this country exhibits

24. In The case of Slovenia, the social loss is lightly smaller for a currency board when the aggregate supply is very steep, but the difference with respect to the ERM2 solution is not statistically significant. For this country, the general solution is ERM2.

25. Indeed, inflation targeting is commonly thought a substitute for nominal exchange rate anchors in monetary and exchange rate policies.

vulnerability to asymmetric demand and supply shocks, with respect to the euro area, and this makes the exchange rate a useful tool of economic policy as stressed by the theory of optimal currency areas. The main sources of idiosyncratic shocks to this country are a rigid func-

Table 7:
Social Losses

Cyprus	*Scenario 1*	*Scenario 2*	*Scenario 3*
Flexible exchange rate	**30,63**	**39.54**	**56.82**
Currency Board	60,58	108,95	200,90
ERM2	246,14	270,34	316,43
Czech Republic	*Scenario 1*	*Scenario 2*	*Scenario 3*
Flexible exchange rate	**3,11**	**4,62**	**20.60**
Currency Board	13.37	24,40	72,56
ERM2	227,46	231.04	253,75
Estonia	*Scenario 1*	*Scenario 2*	*Scenario 3*
Flexible exchange rate	53,79	40,74	36,13
Currency Board	**26,04**	**26,10**	**26.14**
ERM2	229,99	231,45	232,25
Hungary	*Scenario 1*	*Scenario 2*	*Scenario 3*
Flexible exchange rate	-	865,01	835,97
Currency Board	-	463,16	482,63
ERM2	**-**	**403,79**	**435,79**
Latvia	*Scenario 1*	*Scenario 2*	*Scenario 3*
Flexible exchange rate	**32,69**	**27,61**	**26,88**
Currency Board	48,82	48,97	49,67
ERM2	239,56	241,99	243,27
Poland	*Scenario 1*	*Scenario 2*	*Scenario 3*
Flexible exchange rate	668,71	507,44	**436,40**
Currency Board	328,02	363,43	470,72
ERM2	**286,16**	**328,78**	536,66
Slovak Republic	*Scenario 1*	*Scenario 2*	*Scenario 3*
Flexible exchange rate	1823,08	726,64	591,93
Currency Board	413,56	398,80	631,10
ERM2	**381,54**	**395,28**	**518,67**
Slovenia	*Scenario 1*	*Scenario 2*	*Scenario 3*
Flexible exchange rate	1444,63	561,93	476,74
Currency Board	1202,73	334,68	**391,84**
ERM2	**594,29**	**284,73**	396,15

26. The rate of guaranteed banking loans to the private sector as a per cent of GDP (0.17) is the lowest among the NEM. For other symptoms of weaknesses in the real side of the economy in the Czech Republic, see, for instance, Backé et al (2004).

tioning of labour markets, accompanied by a relatively slow labour productivity growth, and chronic weaknesses of the banking sector[26]. During the transition years, these problems triggered capital outflows –which have been largely liberalised- and have forced the country to abandon more controlled exchange rate regimes[27].

As far as the case of Latvia is concerned, the reason for advising higher flexibility in the exchange rate, compared to the rigid peg to the SDR, currently in force in this country, also lies in real factors. Latvia exhibits asymmetric demand and supply shocks with respect to the euro zone, probably as a result of its relatively low trade integration-in particular, intra-industrial trade- with this area[28]. In fact, trade with EMU countries as a share of GDP hardly overcomes 30 per cent in this country. This index is lower than half the levels in the remaining NMS countries. Our results suggest that the Latvian authorities should let their currency to adjust freely during an interim phase before adopting the euro as the sole reference currency.

The arguments in favour of a flexible exchange rate regime in Cyprus are even stronger than for Latvia, since the degree of economic integration of this country with respect to the euro area is lower. Our empirical analysis reveals indeed that this country is affected by asymmetric supply shocks with respect to the euro zone as a whole. The evolution of exchange rate arrangements, shown in Table 1, indicates that, in fact, the exchange rate strategy of this country has moved towards more flexibility since 2000. We believe that letting the Cyprus pound fluctuate within the ±15% bands, which is the strategy in force since the year 2001, may satisfy our prescription. Moreover, this arrangement avoids unnecessary formal regime shifts under the current circumstances. The experience of the last years proves indeed that the Cyprus pound has de facto fluctuated within a much narrow range.

The results of Table 7 strongly recommend participation of Hungary, the Slovak Republic, Slovenia and Poland (except for the case of a very steep aggregate supply) in the ERM2, under the limited flexibility regulated by the Maastricht Treaty. The reasons for this stricter exchange rate arrangement, compared to the regime pre-

27. The Czech Republic abolished its Deutsche mark and US dollar-based currency basket in May 1997, and has, since then, floated its currency.

28. The OCA theory establishes that weak trade links between countries are expected to increase both the exposure to asymmetric shocks and the heterogeneity in the policy responses and adjustments to them.

scribed to the Czech Republic for instance, are of both monetary and real nature. On the one hand, all these countries need the ERM2 monetary credibility to reduce their current inflation bias and/or to prop up the inflation rate at the low level recently reached[29]. Actual participation in the ERM2, and in particular the policy coordination and surveillance that this mechanism imposes, will further enhance the credibility of NMS countries macroeconomic policies and, in general, eliminate any significant monetary policy bias. On the other hand, since asymmetric supply shocks with respect to the euro zone are not likely in these four countries –as has been confirmed by our VAR analysis-, the nominal exchange rate is less necessary for real adjustments[30].

Early entry into the ERM2 is easier for countries, such as Hungary, that have followed a unilateral "ERM2 shadowing" strategy and experienced a moderate exchange rate variability in recent years. It should be stressed, however, that the specific timing of ERM2 entry also depends on a factor that has not been treated explicitly in our model, which is fiscal consolidation. Prior to joining the system, the countries must put in place sustainable and credible medium term fiscal strategies. At the current stage, among the clear ERM2 candidates, only Slovenia fulfils the Maastricht fiscal criteria, whereas Hungary and the Slovak Republic are planning substantial cuts in their fiscal deficits over the next few years. The fiscal consolidation efforts are less ambitious in Poland, whose government intends to continue running public sector deficit of more than 3 per cent of GDP throughout 2005 and 2006.

Our analysis assigns to Estonia the same exchange rate regime that prevails in this country since 1992, that is, a currency board. This solution is compatible with participation in the ERM2, and may be also justified for economic reasons. First, since this country is very small and open, especially with respect to the euro zone, its exchange rate is not a useful tool for macroeconomic adjustment. Secondly, its supply shocks are positively correlated with those of the euro zone. Thirdly, its fixed exchange rate has been backed so far by strong monetary and fiscal policies and flexible wages; furthermore, participation in the ERM2 will enhance the credibility of these policies. Finally,

29. Only Poland and Slovakia exhibit now rates of inflation under 4%, which is a low figure compared to the high levels reached in 2000 (more than 10% in each country).

30. According to data of the year 2003, trade of these countries with the euro area, as a share of GDP, goes from 61.7% (Poland) to 69,5% (Hungary).

the experience provided by the transition years of this country indicates that possible current account deficits may be financed with foreign direct investment inflows. Finally, it is interesting to note that for Slovenia the best way to participate in the ERM2 in case of very step aggregate supply is also a currency board with the euro. All in all, the results derived through the computed social losses seems to be in agreement with those obtained comparing the size of supply shocks with the correlation coefficients of supply shocks in each country with respect to the euro area (Figure 3).

6. Conclusions

In this paper we have examined the desirable exchange rate arrangements for eight of the recently joining EU economies, along to their current run-up to EMU. To this purpose, in the theoretical part of the paper we have used a macroeconomic model for an open economy that includes two ingredients especially convenient for our task. Firstly, its social loss function includes internal market distortions and/or a technological gap of the domestic country with respect to the euro area. This is especially useful to investigate the inflation bias in countries that have still not finished the transition phase to a full-fledged market economy. Secondly, it assumes forward-looking behaviour of both firms and households. This feature has important implications for the stabilisation effects of macroeconomic policies.

In the empirical part of the paper we have estimated SVAR models in order to extract variances and covariances between shocks to each new Member State (NMS) and to the euro zone, which are necessary to compute individual social losses under each exchange rate arrangement. Our main result is that the optimal choice varies depending on the institutional and structural features of each economy, and on the likely source and nature of economic shocks to which it is exposed with respect to the whole euro area. Interestingly, the results for each country seem to conform to the general prescriptions that one would derive from the theory of optimal currency areas.

The recommended exchange rate systems are as follows: the Czech Republic should maintain its managed flexible exchange rate with respect to the euro, coupled with its current inflation targeting arrangement. The reason may be that this country is still hit by asymmetric shocks and needs to both complete its transition process and improve

the functioning and productivity of the labour market. The same exchange rate is prescribed for Latvia and Cyprus. In these cases, the rationale would lie mainly on the asymmetric nature of their supply shocks, which in turn might be provoked by their relatively low degree of economic integration with the euro area.

Our analysis suggests that Slovenia should participate in the ERM2, under the flexible conditions stipulated by the Maastricht Treaty, –or even with a currency board with respect the euro if scenario 3 is likely– as soon as possible, and that Hungary, the Slovak Republic and Poland should also adhere to this regime after achieving a critical mass of fiscal consolidation and adopting a central rate close to equilibrium with respect to the euro[31]. The explanation is twofold. On the one hand, these countries still need a credible inflation anchor (that can be provided by the institutionally regulated Maastricht criteria); and, on the other, they can easily adopt the ERM2 discipline since the nature of their supply shocks is essentially symmetric with respect to the euro zone. Finally, for Estonia we derived a currency board with respect to the euro, which is in fact the system in force in this country since 1992. Nowadays it could be maintained and reinforced within the ERM2. Again, this choice may be rationalised taking into account several economic features of this country that make the exchange rate a non-necessary tool for economic policy adjustments. The most relevant are: small size but high degree of openness with the euro area, and relatively high flexibility of its labour market. These characteristics could, in turn, justify the positive correlation of the supply shocks of this country with respect to the euro area.

It is evident that new assessments and evaluations will be needed as economic and institutional conditions change in the countries considered in this study. For instance, given that parameters and the nature of shocks evolve endogenously, it is expected that increased policy coordination within the enlarged EU will make the Czech Republic, Latvia and Cyprus eligible for ERM2 participation in the near future. Stability in foreign exchange markets requires, in fact, that any forthcoming change in the recommended arrangements evolve towards stronger exits for the country or countries involved. In other words, exchange rate arrangements must be replaced by solutions that are closer to currency unification with the euro zone as the convergence process goes ahead.

31. According to the simulations undertaken by Bulír and Smídková (2005), the Hungarian forint, and the Polish zloty should undergo certain devaluation, in order to bring their central parity with respect to the euro close to equilibrium before entering the ERM2. Otherwise, these two currencies would probably experience serious difficulties during their stay in the ERM2, and create problems of current account sustainability.

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Appendix: Graphical Representation Of Shocks

Figure 1.
Demand shocks in the euro zone and the NMS

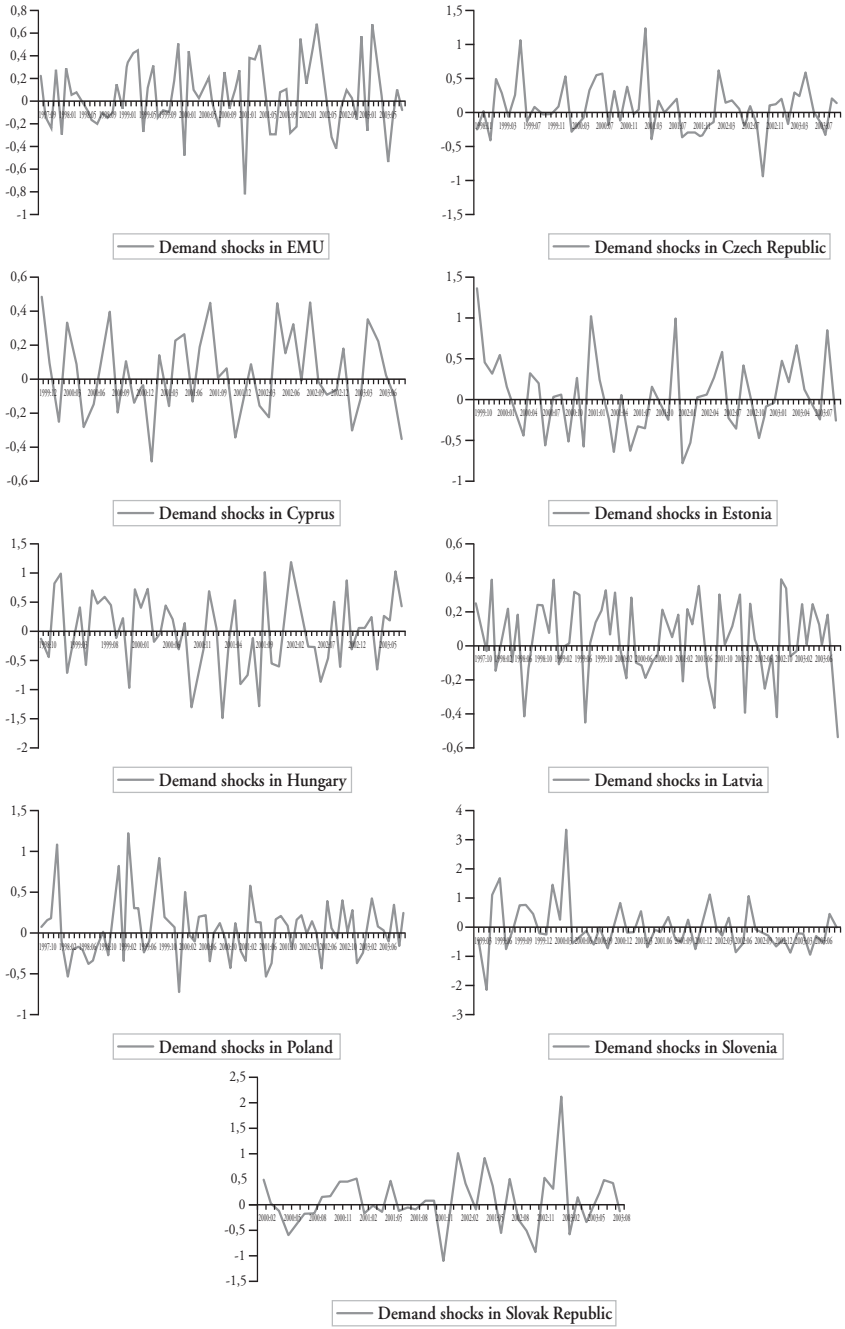


Figure 2.
Supply shocks in the euro zone and the NMS

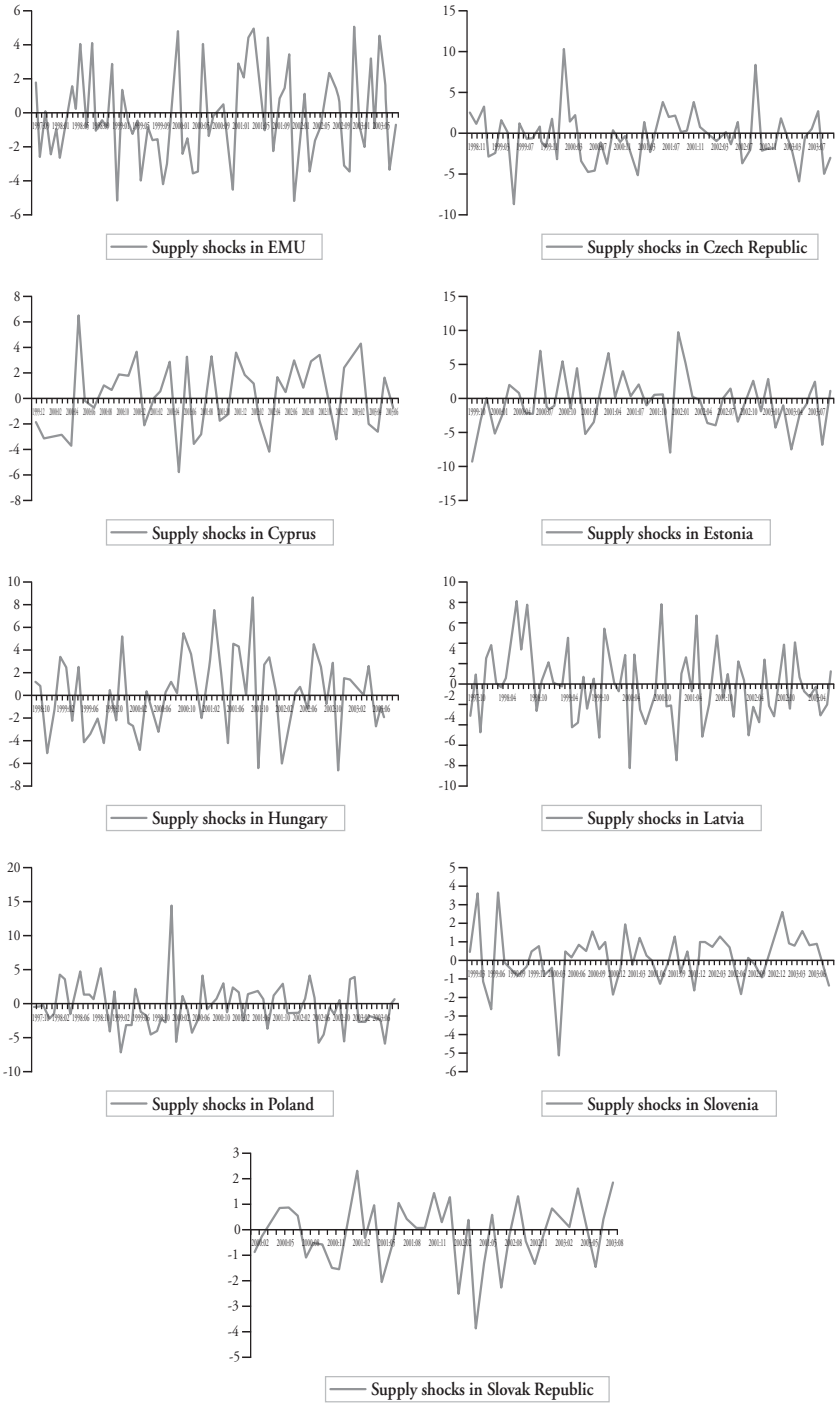
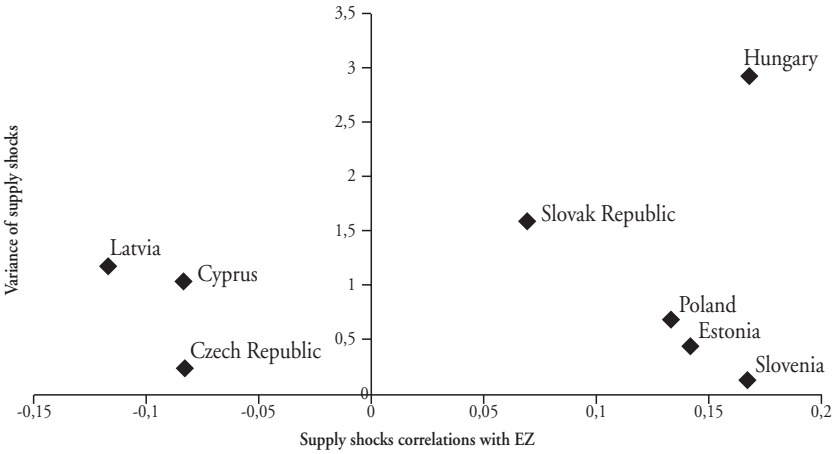


Figure 3.
Standard deviation of suplly shocks V.S. correlation of supply shocks with the euro zone



Comments

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Banco de España

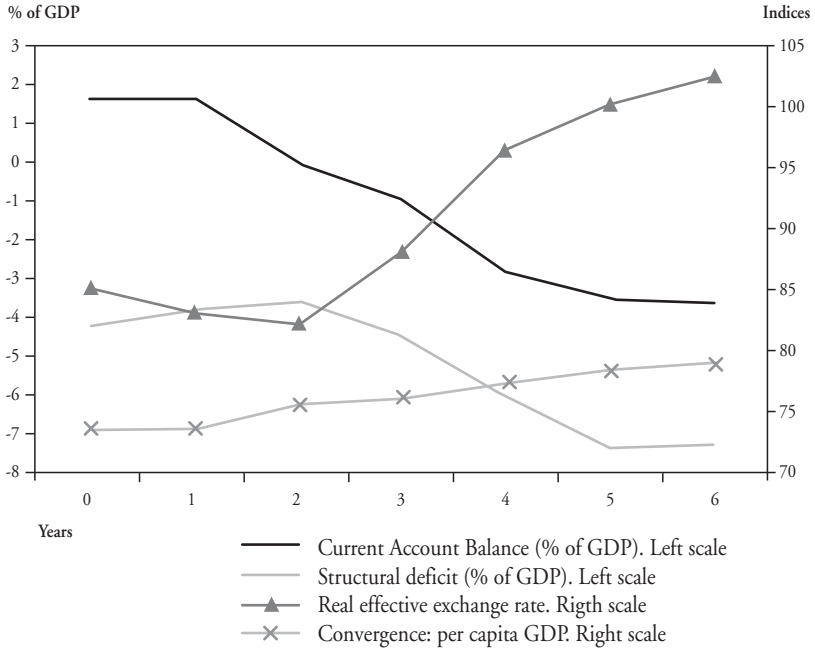
The paper object of this discussion comes very timely, shortly after the entry of ten new members to EU and it makes a relevant contribution to one of the star issues for the next years in EMU: the exchange rate strategies to join the euro by the new members. Furthermore, the paper has the virtue to merge theory, empirical evidence and welfare analysis, so that the motivation and the conclusions are well-grounded, and rounded.

Having said this, my comments will address three different issues. I will first take advantage of our own Spanish experience within the European Monetary System in the run-up to EMU to put a note of caution regarding the strategy to achieve a smooth transition to EMU by new member countries. Second, I will make a couple of observations regarding the theoretical model and finally I will argue that the suggested identification scheme of the shocks –and therefore, the assessment of the exchange rate strategies should be improved to attain a more accurate evaluation.

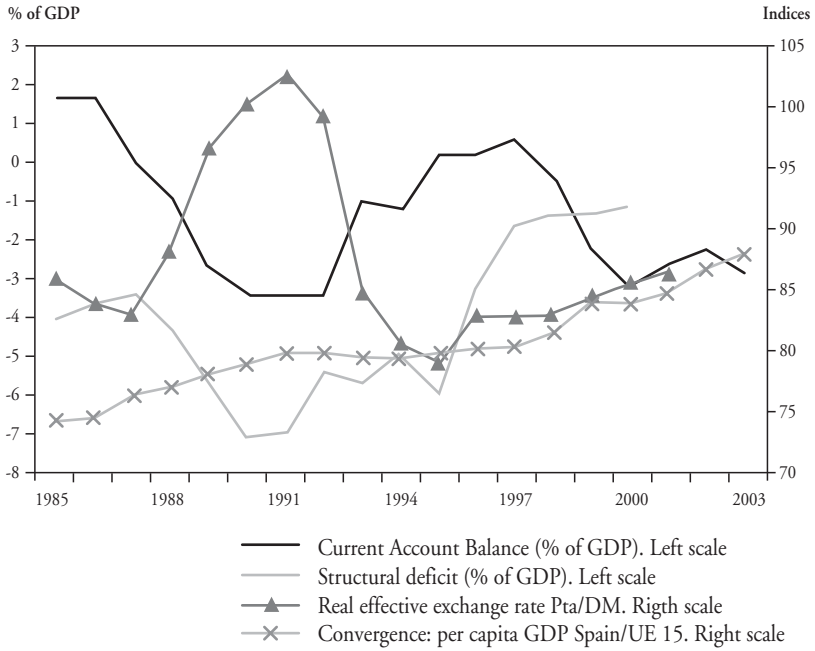
1. THE MIRAGE OF A SMOOTH CONVERGENCE

The following chart displays the typical process of convergence within EU, which can be applied both to Spain (or Portugal) in the eighties, and to most new EU since the mid-nineties [the chart actually refers to Spain since 1986 to 1991]. We can observe a process of remarkable real convergence, to which the strong real appreciation of the exchange rate can be linked through the Balassa-Samuelson hypothesis (whereby, strong productivity gains in the tradable sector –in process of liberalisation- translate into a fall in relative prices for tradables, and thus into an strengthening of the currency). Moreover, the financing of the development process is done through strong capital inflows, thus the worsening of the current account balance. The

Integration and convergence



Spain



only inequivocal negative feature in the chart is the deterioration of the structural fiscal balance, although, given the economic expansion underway and the reduction in real interest rates which also tends to reduced the fiscal imbalances, the observed fiscal position is masked. But this apparently smooth convergence process came -as we well know- to an abrupt end in September 1992 and there was necessary to repeatedly devalue the peseta to put the convergence process back onto a virtuous path. The real adjustment, the push for reform, fiscal discipline and the lure of EMU, which brought about a decisive change in agents' attitudes favoured the positive outcome of a smooth entry in EMU for Spain.

New member countries share some of these features. The widening current account balance –9% in Hungary, 6% in Chequia last year, for instance- is worrisome, since, according to the balance-of-payments theory of exchange rate determination, it would grant a future exchange rate correction, difficult to manage within EMS II. However, there are two considerations which mitigate the concern. First, that the current account imbalance is the other side of strong direct investment inflows. Actually, this was the case for Spain in the eighties. However, the second consideration is also related to direct investment, but diverges from what happened in Spain then: productivity growth-fostered by new foreign capital- is robust and, according to the mentioned Balassa-Samuelson hypothesis, this can sustain the real exchange rate appreciation, and thus there would be no need for adjustment. The tension between the two forces –current account imbalances pushing for depreciation and productivity convergence favouring appreciation will determine in the end the future evolution of the exchange rate. On the contrary, a third consideration raises undoubtedly concern: large fiscal deficits like those observed in new member countries –most of them well above the 3% Maastricht criteria, despite the strong growth -suit badly for balanced growth and a stable macroeconomic framework. All in all, new member countries should carefully ponder the best path to EMU, in particular the target time for accession and the degree of flexibility to that time.

2. TWO QUESTIONS ON THE MODEL

The first criticism focuses on the modeling of rigidities, the parameter k, in equation (1)

$$L = \frac{1}{2} E_t \left\{ \sum_{j=0}^{\infty} \beta^j \left[\pi_{t+j}^2 + \lambda \left(y_{t+j} - k \right)^2 \right] \right\} \qquad (1)$$

The authors link the parameter k to labour market rigidities and technological gaps, which is reasonable, but the solution of the model in equation (5) displays an inconsistent feature: if there exists rigidities (*k> 0),* the output gap which minimises the loss function for low levels of inflation is positive: $y_t = \frac{-\alpha}{\lambda} \pi_t + k$. One could, on the contrary think that if there are rigidities the output would fall short of its potential level. Furthermore, the rigidities *k* also imply that the optimal inflatio target under Svensson's scheme is negative: $\pi^b = \frac{-\lambda}{\alpha} k$. From these comments, it follows that an alternative way to model rigidities is in order, for instance, by changing its sign in the loss function.

The second point is more subtle but probably more relevant. As mentioned above, the main suspect to explain the sustained observed appreciation of new members in the last years has been productivity convergence, on the basis of the so-called Balassa-Samuelson hypothesis. Relative productivity gains imply that exchange rate appreciations are <u>not</u> associated to competitiveness losses (indeed, competitiveness remains constant in the Balassa-Samuelson model) and therefore exchange rate appreciation should not impinge on demand, contrary to what equation (3) of the model suggests:

$$y_t = -\varphi \left[i_t - E_t \pi_{t+1} \right] + E_t y_{t+1} + \delta \left(s_t - p_t \right) + d_t \qquad (3)$$

In other words, a stable real exchange rate coupled with productivity convergence would imply a gain in competitiveness Thus the notion of 'equilibrium' appreciation should be introduced in the model (related to differential potential growth, for instance). Being $\hat{g}_t$ the equilibrium exchange rate, the previous expression should include that term:

$$y_t = -\varphi \left[i_t - E_t \pi_{t+1} \right] + E_t y_{t+1} + \delta \left(\left(s_t - p_t \right) - \hat{g}_t \right) + d_t \qquad (3^*)$$

3. Shock identification

In the second part of the paper, a optimal currency areas analysis is performed in order to determine how similar are the shocks that impinging new EU members and compare them to euro area. The idea is that the more similar the shocks are, the lower the cost of losing the exchange rate instrument. The underlying idea is correct, but, in my view, the implementation is inadequate to some extent,

although this flaw is shared by most of the literature on the issue, referenced in the text. More precisely, the identification of shocks through a SVAR on which a particular identification scheme is imposed aims at recovering supply and demand shocks, as follows (see (11) in the text):

$$\begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix} = \sum_{i=0}^{\infty} L^i \begin{bmatrix} A_{11i} & A_{12i} \\ A_{21i} & A_{22i} \end{bmatrix} \begin{bmatrix} \varepsilon_{dt} \\ \varepsilon_{st} \end{bmatrix} \tag{11}$$

where demand shocks have no long run impact on growth. The problem with this identification scheme is that demand shocks embed monetary shocks, precisely those that will vanish after EMU. Therefore, a scheme which is valid to assess EMU should filter out those shocks. A feasible alternative we proposed in a previous paper[1] is conveyed in the following long-run impact matrix:

$$\begin{pmatrix} \Delta y \\ \Delta q \\ \Delta p \end{pmatrix} = \begin{pmatrix} c_{11}(1) & 0 & 0 \\ c_{21}(1) & c_{22}(1) & 0 \\ c_{31}(1) & c_{32}(1) & c_{33}(1) \end{pmatrix} \begin{pmatrix} \epsilon_{AS} \\ \epsilon_{IS} \\ \epsilon_{n} \end{pmatrix}$$

where demand shocks are split into IS and monetary shocks (ϵ_{IS} and ϵ_n), respectively). IS shocks do impact the real exchange rate (q) and prices, while monetary shocks only impact prices in the long run.

1. Alberola,E, J. Ayuso, D.Lopez Salido (2000), When may peseta depreciatons fuel inflation?, Applied Economics , 32, 1037-1049

Comments

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1. The issue

With the enlargement of the European Union (EU) in 2004 by ten new member countries, the question arises how the acceding countries start the path towards the euro. Unlike some of the longer-time member countries, none of the new EU member countries has an opt-out clause in the European Monetary Union (EMU): once the path to the euro is initiated, there is no way back.

The acceding countries have to do their best to eventually also adopt the euro as their currency. In fact, they enjoy a high degree of openness and integration with the European Union. As a consequence, and provided the conditions are right, the vast potential benefits from joining the euro area will outweigh the costs associated with giving up an independent monetary policy and a separate exchange rate.

The benefits are well-known. They stem from a variety of factors, including the elimination of exchange rate risks, the reduction of transaction costs and increased price and cost transparency. They also follow from making the economy less vulnerable to external shocks and from a further reduction of country risk premia.

Monetary integration is also an important element of the broader European integration process. The single currency serves as a catalyst for further progress in other areas of integration, such as completion of the single market and enhancing economic policy co-ordination. But the single currency also contributes to make stronger the shared "European identity" within the Union.

To participate in the EMU and to fully exploit its beneficial effects, the acceding countries must fulfil the Maastricht criteria. Therefore they must achieve a high degree of sustainable convergence with the euro area, being exchange-rate convergence criterion one of

the key issues. Fulfilling the criterion requires participation in the new Exchange Rate Mechanism (ERM-II), fixing the participating currencies against the euro within a fluctuation band and maintenance of exchange rate stability.

The exchange rate is not an isolated economic variable. The exchange rate acts in the context of (and in line with) the other key variables that shape a country's internal and external economic balance. Therefore, the exchange rate regime is just one element in a set of economic policies and does not have an exclusive or unique position, being the question of what drives an exchange rate regime choice is an important one.

Whether a given exchange rate regime is sustainable and plays a stabilising role depends primarily on whether other variables and macroeconomic policies evolve in a balanced, sustainable and mutually consistent fashion. That is why the new Exchange Rate Mechanism (ERM-II, fixing the participating currencies against the euro within a fluctuation band) or any other fixed exchange rate regime puts high demands on economic consistency and macroeconomic stability. From this point of view, the exchange regime should be an integral part of the overall economic, financial and monetary framework of the acceding countries.

2. THE AIMS

In this paper, García-Solanes and María-Dolores investigate the appropriate exchange rate regimes for the accession countries using both theoretical and empirical analysis. In doing so, they make an important contribution to a relevant issue.

They use an interesting data set and apply an appropriate technique to answer this question, shedding further light on this area of research.

3. THE ANALYTICAL TOOLS

The authors back their analysis with an economic model that allows us to identify the key elements. In particular, the model takes into account the size of the internal market distortions and technological gaps of the acceding countries to conveniently specify the difference

in the countries' economies.

They estimate a structural vector autoregression (SVAR) model to extract the necessary values of variances and covariances of shocks.

They compute social losses corresponding to three exchange rate arrangements to derive the optimal solution.

4. The empirical results

In Table 1, the authors make use of the IMF *de jure* classification. Nevertheless, the *de facto* exchange rate policy adopted by monetary authorities has tended to differ from the announced *de iure* exchange rate regime, which is why IMF classifications are not always a good guide to the true exchange rate intentions of said authorities. New literature seeks to achieve two linked objectives, namely, to detect divergences between *de iure* and *de facto* regimes and to assess the consequences of these differences on the relevance of exchange rates for macroeconomic performance[1].

The results must be interpreted with caution. On the one hand, we must bear in mind the relative short sample used in this paper. On the other hand, these countries have been subject to a process of transition to a market economy during this period, which complicates the assessment.

Interestingly, the authors find sensible correlation coefficients, even though there is a lot of dependence across countries and time that could affect the results.

Figure 3 (standard deviation of supply shocks vs. correlation of supply shocks with euro area) graphically summarizes the empirical findings. In fact, the final exchange-rate regime classification could be based on the information provided by this figure.

The authors make a sensitivity analysis considering different values for the aggregate supply parameter (α), but not for the discount factor β. In addition, they use π^M=3, although one would expect that a natural choice could be π^M=2 (i. e., to enhance its exchange-rate credibility. the domestic authority would adopt the same inflation target established by the European Central Bank to achieve price stability).

1. See Coudert and Dubert (2004) for a survey of studies on implicit exchange rate regimes. Reinhart and Rogoff (2004) examine the relevance of the exchange rate regime classifications for empirical macroeconomics.

The recommended exchange rate regimes do not take into account the stabilising effects that a credible target zone as the ERM-II could have on the exchange rate via agents' expectations. The ERM experience suggests that the sustainability of a given regime is affected both by fundamental variables and by investor's expectations about government behaviour (see, e. g., Pérez-Bermejo and Sosvilla-Rivero, 2004).The ERM experience also indicates that to prevent currency crises it is not sufficient to pursue sound economic policies, but policymakers must enhance their reputational capital with respect to their commitment to maintain the exchange rate around the central parity (see, e. g., Sosvilla-Rivero and Pérez-Bermejo, 2005). Both lessons stress the need for independent central banks, inflation targeting and co-ordination with ECB to intervene as soon as there is a deviation from the central parity.

5. NORMATIVE INTERPRETATION

The normative interpretation of the results is somehow forced. In fact, almost all acceding countries have consistently reported deficits in their combined current and capital account balance, most of the financing of these deficits coming from net direct investment inflows. In addition, most of them have experienced a significant disinflation process and all have shifted the orientation of the monetary policy towards the achievement of price stability in the medium term.

Most of the acceding countries have independent central banks that could help to reinforce the disinflation process and to increase the credibility of their exchange rate commitments.

Some have already adopted exchange rate arrangements that have helped to the success of the disinflation process. There have been improvements in the functioning of the labour and products markets. Finally, most of theses countries need to advance further in the implementation of a sustainable and credible fiscal consolidation path.

The recommendation for Estonia has been materialised on 27 June 2004, since it joined the ERM-II with its existing currency board arrangement in place, as a unilateral commitment, thus placing no additional obligation on the European Central Bank.

Slovenia also joined the ERM-II on 27 June 2004, in line with the recommended exchange rate arrangement.

6. The years to come

A further unification of the acceding countries exchange rate strategies could contribute to more intra-regional trade integration and macroeconomic stability, adding an additional growth stimulus for both the whole region and the European Union.

The rise of the euro area will not be restricted to the central and eastern European countries and the (still) EMU-outs Denmark, Sweden and United Kingdom. Due to network externalities of a large euro area, more countries might find it attractive to stabilise exchange rate against the euro

In fact, reduced daily exchange rate fluctuations suggest that Croatia, Morocco, Norway, Switzerland and Tunisia could have being pegging their currencies more or less tightly to the euro. Moreover, Bosnia-Herzegovina, Montenegro and Macedonia have adopted tight currency board arrangements or use the euro as legal tender. Finally, Russia, Belarus, Ukraine, Algeria, Egypt or Turkey might also reconsider their exchange rate strategies.

Therefore, the euro might challenge the dollar as the world currency, and papers like this one contribute to a better understanding of the issues involved in this process and could help to clarify the right selection of exchange rate regimes for these countries that in the future might be interest in linking their currencies to the euro.

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Discussion

Alex Cuñat suggests that while the authors use a two-country model, the issue they are analyzing is one in which many countries are involved. Thus, perhaps a multi-country model with a richer set of interactions among countries could be a better framework.

José Viñals finds inconsistencies in some of the results in the paper. The countries that the authors find would do better in rapidly participating in ERM2, because it would be good for their inflation rate, are Hungary and Poland. But these countries are the least prepared to join ERM2 on macroeconomic grounds. That fixed or flexible exchange rates are stabilizing depends not only on the nature of the shocks but also on the policy mix of each economy. Hungary and Poland have very large fiscal imbalances, and that is the main difficulty to gain credibility in the inflation front.

Philippe Bacchetta finds that some catch-up element should be included in the utility function, given that convergence and catch-up are the main concerns behind Europe's enlargement. The presence of such component might alter some of the results of the paper.

Stephen Cecchetti disagrees with some of the parameter values used in the analysis. In particular the weight that the monetary authority gives to output deviations from its natural level is unrealistic according to the ECB's objectives.

Javier Andrés says that the calibration of the rate of time preference is implausible since it implies a very high real interest rate. He also argues that the choice of the Calvo model without indexation may be inadequate in this setting since this model implies a permanent output inflation trade-off, thus violating the Natural Rate hypothesis; this also contributes to enhance the importance of output fluctuations in the choice of the exchange rate regime.

José García Solanes acknowledges all comments and suggestions, most of which are related with the particular modelling strategy. They are taken on board and will be included in the final draft of the paper.

Long-run determinants of inflation differentials in a monetary union*

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Abstract

This paper analyses the long-run determinants of inflation differentials in a monetary union. First, we aim at stablishing some stylized facts relating the regional dispersion in headline inflation rates in the euro area as well as in the main components of the consumer price index. We find that a relatively large proportion of it occurs in the Service category of the EU´s harmonized conumer price index (HICP). We then lay out a model of a monetary union with fully flexible prices, the long-run properties of which are analyzed. Our model departs in several respect from the Balassa-Samuelson hypotheses. Our results are in contrast with the result that movements in the real exchange rate are mainly driven by regionally asymmetric productivity shocks in the traded sectors. Our results point instead to relative variations in productivity in the non-traded sector as the primary cause of price and inflation differentials, with shocks to productivity in the traded sector being largely absorbed by movements in the terms of trade in the regional economies. These shocks are also found to largely drive the variability of real wages at the country level.

1 Introduction

The experience of a major transformation in the exchange rate regime associated with the launch of the euro has spurred much

* This paper does not reflect views or opinions of the European Central Bank but solely those of its authors. The authors are grateful to Kosuke Aoki, Philip Lane and Roger Farmer for very helpful dicussions and to Gianni Lombardo, Klaus Masuch, Roberto Motto and Sergio Nicoletti-Altimari as well as participants at the *XVII Simposium Moneda y Crédito* in Madrid and CEPR conference *Designing a Macroeconomic Policy Framework for Europe* in Barcelona for helpful comments. Any errors are the responsibility solely of the authors.

research aiming at understanding the scope for, magnitude and persistence of inflation differentials across the regions of a monetary union as well as their potential relevance for monetary policy making. The initial years of EMU coincided with a change in trend in the observed degree of dispersion in inflation rates across euro area countries. In the run-up to monetary union, inflation rates across member countries had largely converged. In the year 2000 the degree of dispersion across countries picked up somewhat and since then a non-negligible degree of dispersion across national inflation rates in euro area has been at times observed.

Early contributions in the literature[1] aimed at accounting for the persistence of inflation differentials within a monetary union such as the euro area in terms of the relevance in this respect of the Balassa-Samuelson effect.[2] Such an explanation based Balassa-Samuelson effect seemed appealing, at least prima facie, taking into account in particular that national inflation rates were highest in the fastest-growing economies such as Ireland, Greece and Spain. However, the focus on a single explanatory factor was gradually superseded by broader explanations[3] in which the observed inflation differentials were accounted for by more complex interactions among various factors such as the presence of heterogeneity in regional market structures (e.g. the degree of market competition), the consequences of common and idiosyncratic regional shocks of both a supply and demand nature and the role of fluctuations in the regions´ terms of trade to transmit and absorb the effects of shocks to fundamentals.

This paper aims at analyzing the determinants of inflation differentials in a monetary union both from an empirical and a theoretical dimension.

First, in order to motivate the theoretical investigation, we first present evidence on the statistical features of observed dispersion in headline inflation rates as well as in changes in the components of the consumer price index,[4] based on the experience of most of the European Union countries conforming the euro area. Our descriptive exercise shows that there is still a sizeable dispersion of HICP inflation rates across euro area countries. In a sectorial

1. See for instance De Grauwe et al (2000).

2. See Balassa (1964) and Samuelson (1964).

3. See Blanchard (2001) for an early dicussion in this respect.

decomposition of this dispersion, we find that most of it originates in the Service category of the HICP (although in some historical periods also the Energy category has signi.cantly contributed to overall dispersion). This suggests that the main source of dispersion in countries.headline inflation rates is in those components of the HICP where non-traded goods are more intensely represented. We then use a dynamic factor model to analyze the sources of dispersion in countries inflation rates, decomposing the aggregate and sectorial measures of dispersion in, on the one hand, a common component - driven by common factors - and, on the other hand, an idiosyncratic component.

We find that the heterogeneous responses, across countries, to a change in the estimated common factor can account for a sizeable fraction of the dispersion in national inflation rates. This is particularly the case for the Non-Energy Industrial goods categories, even if the cross-country dispersion of the inflation rates of items in this category is relatively quite low. Moreover, this also applies particularly to the Services component of the HICP, which, importantly, is instead characterized by a relatively high level of dispersion. These results overall underline the large relative contribution that the observed persistence in regional inflation differentials in the Services component of the HICP make to overall persistence in observed headline inflation differentials across regions.

Second, we build a stylized model of a monetary union comprised of two regions, with a view to gauging the relative contributions in explaining the qualitatively features of the data of, on the one hand, innovations in the shocks and, on the other hand, structural differences in the regional economies. In each of the two regions of the model monetary union, two productive sectors are assumed, a traded and a non-traded goods sector. Each region is specialized in the production of a distinct, non-overlapping bundle of traded goods. The law of one price holds for each of the traded goods produced. Thus, consumer price and inflation differentials arise in the model as a consequence of movements in the relative prices of non-traded goods. This is the standard channel

4. All data relating consumer prices, both relating headline inflation in the euro area, countries.consumer prices and subcomponents of the consumer price indes at the euro area and country levels, will refer to Eurostat.s Harmonised Index of Consumer Prices (henceforth HICP).

emphasized also by the trade literature on the Balassa-Samuelson effect.

Some distinct aspects of this model relative to the literature are described in the following.

One important feature is that capital is not mobile and that labour mobility within sectors of the same country can be imperfect for the introduction of imperfect substitutability between different varieties of sector-speci.c labour. This device generates wage differentials across sectors, which is a desirable feature from an empirical perspective (e.g. Ortega, 2003) and introduces an amplifying effect on the relative price movements in response to sectorial shocks.[5]

For the assumption of country specialization in the production of traded goods, terms of trade movement are critical for the transmission mechanism of shocks. As has been recently pointed out in the literature (Benigno and Thoenissen, 2003), a positive productivity gain in the tradable good sector has two counteracting effects on the overall price level, with upward pressure on the relative price of non-tradables offset by a worsening of the terms of trade. Which effect dominates depends on the relative values of the elasticities of substitution in consumption preferences between home and foreign tradables and the degree of labour mobility.

Interestingly, we show that the Balassa-Samuelson result .that movements in the real ex- change rate are signi.cantly affected by asymmetric shocks in the traded productivity.is mod- i.ed and for realistic parametrizations of the model of limited empirical relevance. Our results point instead to relative variations in productivity in the non-traded sector as the primary cause of price and inflation differentials, with shocks to productivity in the traded sector being largely absorbed by movements in the terms of trade in the regional economies. These shocks are also found to drive the variability of wages at the cross-country level.

New insights on the explanation of real exchange rate movements emerge in our framework. Namely, a balanced (i.e. that affects both sectors) productivity shocks in one country may have a role in explaining real exchange rate movements or, in a monetary union, inflation differentials. In particular, we find that, for plausible parameter values, a balanced increase in productivity in

5. Inter-regional mobility is not allowed in the model, even over the lung run.

one country has a negative and sizeable impact on the consumer price of the country relative to the rest of the area. Moreover, our framework permits that demand shocks play a role in generating long-term price or inflation differentials across countries.

The paper is structured as follows: Section 2 presents the descriptive statistics on euro-area inflation differentials and proposes a dynamic factor model decomposition of it. Section 3 presents the structure of the model. Section 4 characterizes the equilibrium and transition dynamics upon shocks in the model, under fully .exible prices. It also shows the long-run impact of permanent increases in the structural shocks. Section 5 presents the variance decomposition of key endogenous variables in the model as a function of the variance of the structural shocks. Section 6 closes the paper.

2 Euro area inflation differentials

This section addresses three empirical questions concerning the euro area economy. How sizable are the inflation differentials in the euro area in comparison to other currency areas? Are the inflation differentials in the euro area a sectorial phenomena, i.e. tradable versus non-tradable? Are the inflation differentials in the euro area the result of differentiated responses to common area-wide factors, or are they due to idiosyncratic (sector/country speci.c) factors?

A number of papers have recently provided empirical analysis of inflation differentials in the euro area. Alberola (2000) is one of the first analysis of post-EMU data speci.cally focusing on cross-country inflation differentials. Recently a more extensive review of empirical evidence and literature has been conducted by the ECB, (ECB, 2003). The latter work surveys a variety of measures of price and cost developments at the national level in EU-12 during the 1999-2002 period and explores different possible macroeconomic determinants. Here we maintain a narrower focus on which are the stylized statistical facts that are more relevant for our analysis. For this, we provide descriptive statistics as well as perform econometric analysis based on dynamic factor models.

The data used are based on the harmonized index of consumption prices (HICP). These data are harmonized indices of consumer prices for a basket of all goods and services consumed by a country, expenditure-weighted. We analyze seasonally adjusted data for the area as a whole and for ten individual countries (all euro countries except for Greece and Luxemburg), for theperiod from January 1990 to February 2004. Excluding Greece and Luxembourg reflects the fact that HICP data series for these countries are shorter than for the other countries in the sample. Both for the euro area and the individual countries HICP we considered the overall HICP inflation index as well as the five main subcomponents in the HICP, namely Services, Industrial Good excluding Energy, Energy, Processed Food and Unprocessed Food.[6]

To set notation, $\pi^i_{j,t}$ is the year on year growth rate of price in subindex j of country i and the aggregate euro area counterpart is $\pi^{euro}_{j,t}$ While π^i_t denotes the overall inflation rate in country i and π^{euro}_t is the overall euro area inflation rate. The inflation differential between country i and the euro area is denoted as:

$$\delta_{i,t} = (\pi^i_t - \pi^{euro}_t);$$

while the dispersion of inflation is measured by the root mean squared around the euro area average, as :

$$\Delta_t = \left(\frac{\sum_{i=1}^{10} \delta^2_{i,t}}{10} \right)^{1/2}$$

The inflation differential between subindex j in country i and the euro area one is denoted as:

$$\delta_{j,i,t} = (\pi^i_{j,t} - \pi^{euro}_{j,t});$$

while the dispersion of inflation in the sub-component j is measured as:

$$\Delta_{j,t} = \left(\frac{\sum_{i=1}^{10} \delta^2_{j,i,t}}{10} \right)^{1/2}$$

The overall dispersion Δ_t is not the weighted average of the sectorial dispersion given the nonlinearity of the transformation. We decompose the overall dispersion into the relative contribution of the

6. The weights of the five subindexes in the euro area HICP index in 2004 are 0.41, 0.31, 0.08, 0.12 and 0.08, respectively.

different subcomponents. To this end, .rst, we assume that the sectorial country weights inside the HICP, $w_{j,i,t}$, are equal across countries, i.e. $w_{j,i,t} = w_{j,t}\ \forall i$, then we define the contribution of sector j to the overall inflation dispersion as:

$$\frac{w_j \times \Delta_{j,t}}{\sum_j w_j \times \Delta_{j,t}}.$$

The cross-country dispersion in inflation has been declining during the 90s across euro area as documented in Figures 1. Dispersion was above 4% in the early 90s while it reached its minimum at 0.26% at the end of 1997. After this point, the previous trend was inverted, starting to edge up again to around 1% between 1998 and 2002. In early 2004 it stood at around 0.64%.[7]

Compared with the degree of dispersion observed within some individual euro area countries, inflation dispersion within the euro area remains relatively high. In particular, the recent degree of dispersion within the euro area is around twice the comparable measures computed across the German *Länder*, the Spanish *Comunidades Autónomas* and the Italian cities. On the contrary, the recent euro area inflation dispersion is quite comparable to the one measured among the 14 US metropolitan areas. The inflation divergence among US cities stayed remarkably constant at around 1 percent for many years. However the analogy is probably misleading, given that US cities are much smaller than EU nations, and their price indices tend to be more volatile.

Despite the possible similarities in the level of inflation dispersion between US and euro area, the high persistence of inflation differential is a characterizing feature of the euro area economy, as noted by Cecchetti, Mark and Sonora (2000). Indeed, in our data set the measured persistence of the inflation differential, $\delta_{j,i,t}$ is very close to the one of a unit root process on average across countries and sectors.[8]

The importance of sectorial pattern in explaining the overall dispersion is addressed in Figures 2-3. Figure 2 shows the dispersion

7. This finding is slightly different from the one reported in ECB (2003), due to the fact that we considered the dispersion of the 10 indicated countries vis-à-vis the euro area while ECB (2003) considered also Greece and Luxemburg.

8. If we measure the persistence of the differential process by the largest autoregressive roots of a fitted ARMA model, it turns out that the largest autoregressive root is 0.981 on average across sectors and countries.

of the year-on-year inflation rates in the euro area countries in the *Services*, *Industrial Good Excluding Energy* and *Energy* sectors toge-ther with the dispersion of the overall index. While Figure 3 presents the contribution of the sectors to the overall inflation dispersion.

Several conclusions can be drawn. First, all the components of inflation contributed to the very low dispersion observed in 1997-1998. Second, the increase on dispersion between 2000 and 2002 can mainly attributed to the dispersion in Services and Energy sectors. Third, Figures 2 shows that the dispersion in the Service sector has been almost always higher than the overall dispersion and its contribution has been increasing over time as indicated in Figure 3, also in line with the increase of the weight of this subcomponent inside the HICP index. Fourth, differently to the Services, the Industrial Good excluding energy index presents a low degree of dispersion and its overall importance is decreasing. Finally, differently from the common wisdom, the dynamic of the Energy subindex is a major source of overall dispersion. This is due both to the large volatility of this subindex but also to considerable heterogeneity in the countries. response to shocks.

Interpreting those results some cautionary remarks should be made. The HIPC is an index of final consumer prices for a basket of all goods and services consumed; so Industrial Good excluding energy price includes also the prices of (tradable) imported goods and a share of final sale services, such as the prices of any non-tradable marketing and other final consumption services; the services component included in the final Industrial good price might induce to overestimate the dispersion of this sector. On the contrary, this is not the case in the Services sector, where the value added deflator of Services almost entirely accounts for the final price of Services, as indicated by the input-output evidence produced by Sondergaard (2003) for some euro countries.

Finally, we address the last of the three questions stated at the outset - namely, whether the observed dispersion in inflation across euro area countries is due to different reaction to area-wide factors or the result of country/sectorial developments. To tackle this question we follow a similar approach to the one employed by Forni and Reichlin (2001) to decompose euro countries GDP growth into a European, a national, and a residual component. We estimate an approximate dynamic factor model[9] on the inflation differential

which allows us to decompose the differential in each countries and sectors as:

$$\delta_{j,i,t} = c_{j,i} + \Phi_{j,i}(L) \times u_t + \xi_{j,i,t} = \chi_{j,i,t} + \xi_{j,i,t} \quad (1)$$

where the first term of the right hand side is the average dispersion over the sample (ideally nil), the second term captures the effect of common area wide shocks, u_t which is allowed to propagate across countries and sectors with a differentiate dynamic, and the last term captures an idiosyncratic dynamic, mainly associated to country or sectorial speci.c developments. We grouped the first and second term into $\chi_{j,i,t}$.

The approximate dynamic factor models exploits the cross-section dimension of a large panel of time series to identify and estimates the part of the time series driven by few common shocks, $\chi_{j,i,t}$. To this end, in order to have proper estimates of the euro area common components in (1), we augmented the sixty time series on differential, $\delta_{j,i,t}$ with 193 monthly macro-economic time series related to the ten euro area countries considered.10 The estimation has been performed on the sample period 1993.01-2003.06. In line with the finding of similar exercises, the results points to the presence of strong commonalities among the 253 variables and the estimated common factors account on average of around 50% of the variance of the 253 variables.[11]

Having an estimate of the two components in (1), we can .rst ask how much of the historical dynamic of differentials is accounted by the identi.ed area wide factors. The table below reports the average across countries of the share of variance of the differentials, $\delta_{j,i,t}$ accounted by common shocks, both for the overall index and for the individual subindexes.

Overall	Services	Industrial	Energy	Proc. Food	Unproc. Food
0.66	0.58	0.67	0.52	0.65	0.42

9. See Stock and Watson (1999) and Forni, Hallin, Lippi and Reichlin (2000).

10. The data considered are, inter alia, main and sectoral industrial production indexes, consumer and producer surveys, producer prices index, financial quantities, interest rates, trade statistics. The data has been seasonally adjusted and transformed to be stationary.

11. The estimation procedure is based on the principal component decomposition of the variance covariance matrix of the data. The estimation indicates the presence of .ve static factors in the models.

It turns out that the Energy and the Services sector are the ones with the large idiosyncratic components, while the Industrial Good excluding Energy and the Processed Food sectors are the most common ones.

The importance of the common factors is also clear from Figure 4-7, where we show how the dispersion in inflation can be decomposed into the part attributed to the common factor, $\chi_{j,i,t}$; and a remaining one, associated to the idiosyncratic part. Figure 4 presents the cross-country dispersion of the overall HICP and its decomposition. The common part is clearly responsible for the large part of the observed dispersion. The idiosyncratic part has a nil contribution to overall dispersion from 1994 to 2000, but it contributes positively to dispersion from 2000 onward. The Service sector presents a behavior similar to the overall index with large part of its dispersion explained by country-speci.c reaction to common shocks. The increase in dispersion since 2000 is mainly associated to the common factor; even if idiosyncratic elements contributed positively both during 2000 and 2002. In the Industrial sector the commonality is even more striking, however it should be noted that the dispersion in this sector is relative low. By contrast, in the case of Energy prices most of the dispersion is due to presence of idiosyncratic factors, see Figure 7.

To conclude, the inflation differentials in the euro area are relevant and persistent. Our proxy of the non-tradable sector, namely the Services sector seems to make a particularly strong contribution to dispersion; this related to both the effects of common as well as the idiosyncratic factors behind the Services component. By contrast, the dispersion in our proxy of the price index of tradable goods - namely industrial goods excluding energy - is relatively limited. Finally, a tentative overall conclusion from our attempt to understand the source of inflation differentials would indicate that they are largely associated to different responses of the ten euro area economies to common, area-wide shocks.

In the next section, we build a model in which the dispersion of prices at the consumer level arises because of dispersion of prices in the non-traded sector and we analyze which shocks are most responsible for generating such a dispersion. We focus on the long-run properties of the model with no aim then at addressing the issue of persistence.[12]

12. This is the focus of a related work, Altissimo et al. (2004).

3 The Model

Observed dispersion in the consumer price level across regions or countries in a monetary union may be decomposed in its shorter-term and longer-term components, with the latter capturing the persistency in price level and inflation differentials. The focus of our paper is on this second component relating to long-lasting price level and inflation differentials across countries. For this, we lay out a tractable model of a monetary union, aimed at analyzing the relative contributions of various structural shocks to explaining the long-run component of the dispersion in prices at the consumer level across countries.

The model monetary union is comprised of two countries of equal population size. Consump- tion preferences depend on non-traded and traded goods. Each country is specialized in the production of a distinct and non-overlapping bundle of tradable goods. Financial markets are complete within and across countries. Labor is immobile across countries but imperfectly mobile within the sectors of a country. Prices are .exible in all sectors of the economy. The law of one price holds in the traded sector and PPP holds at the level of traded goods. The model permits to study deviations from PPP at the consumer level which arise as a consequence of movements in the relative prices of non-traded goods.

Our model is closely related to recent open-economy models, like Obstfeld and Rogoff (2000) who introduces non-traded goods in stochastic models with sticky prices. Benigno and Thoenissen (2003) use a similar model to study the real exchange rate behavior of UK with respect to the Euro area with the purpose of analyzing whether supply shocks can account for the real exchange rate appreciation in the late nineties.

In reference to the recent literature on monetary unions our model is closely related to Duarte and Wolman (2002, 2003). Their analysis is richer in two respects: first, they allow also for the presence of producers.price discrimination when selling same traded good in different countries; second, they endow .scal policy rules with a non-trivial role in the reduction or ampli.cation of inflation differentials. This results from their assumption that lump-sum taxes are not available to governments. In particular, Duarte and Wolman (2002) find that their model can deliver more inflation dispersion following productivity shocks than what is observed in the data, while they find

that government spending shocks give rise to a negligible degree of dispersion. By contrast to this analysis, our approach is limited to the case in which only lump-sum taxes are available.

Andrés et al. (2003) analyzes a model in which only traded goods exist and in which price discrimination across countries - made possible by differences in the degree of market competition across the countries - is allowed for. They show that their model can account for sizeable inflation differentials and that the driving force of the price dispersion in the traded sector originates more from the mechanism of price discrimination rather than on price rigidity. Angeloni and Ehrmann (2004) present a more stylized 12-country model of the euro area and in particular they focus on the importance of assuming a role for inflation lags in the aggregate supply equation. They find that this additional source of inflation persistence is important in driving up inflation dispersion in the currency area. There are other papers that have analyzed monetary models of currency areas, as Benigno (2004), Beetsma and Jensen (2004) and Lombardo (2004). However these models do not allow for price dispersion at the consumer level and mainly focus on the role of the terms of trade in stabilizing asymmetric shocks, when prices are sticky.

3.1 Households

We consider a model of a currency area composed by two countries, Home (H) and Foreign (F). Each country is populated by a measure one of households. A generic household j belonging to either country H or F maximizes the following utility function:

$$U_t^j \equiv \mathrm{E}_t \sum_{s=t}^{\infty} \beta^{s-t} \left[U(C_s^j) - V(L_s^j) \right],$$

where E_t denotes the expectation conditional on the information set at date t and β is the intertemporal discount factor, with $0 < \beta < 1$. Households derive utility from consumption and disutility from supplying hours of work.

There are two classes of goods in both economies: traded and non-traded goods. Each country produces a measure one of goods, a fraction γ (γ^* in region F) – with $0 < \gamma, \gamma^* < 1$ - is composed by traded goods. The remaining fractions are non-traded goods. The consumption index C_t^j in region H is de.ned as a Dixit-Stiglitz

aggregator of indexes of traded, C_T^j ; and non-traded goods, C_N^j as it follows

$$C^j \equiv \left[\omega^{\frac{1}{\varphi}}(C_T^j)^{\frac{\varphi-1}{\varphi}} + (1-\omega)^{\frac{1}{\varphi}}(C_N^j)^{\frac{\varphi-1}{\varphi}}\right]^{\frac{\varphi}{\varphi-1}},$$

where φ is the elasticity of substitution between the bundles C_T and C_N with $\varphi > 0$ while ω denotes the share of traded goods in the general consumption basket, with $0 < \omega < 1$: (This share may be different for households in region F and it will be denoted by ω^*:) The traded goods are non-homogenous and differentiated in consumption preferences. They are also produced with different technologies. In particular the index C_T^j is defined as a Dixit-Stiglitz aggregator of the bundles of home-produced traded goods, C_H^j, and foreign-produced traded goods, C_F^j, in the following way

$$C_T^j \equiv \left[n^{\frac{1}{\theta}}(C_H^j)^{\frac{\theta-1}{\theta}} + (1-n)^{\frac{1}{\theta}}(C_F^j)^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}},$$

where θ, with $\theta > 0$, is the elasticity of substitution between the bundles C_H^j and C_F^j and n; with $0 < n < 1$; denotes the share of home-produced traded goods in the overall index of traded goods. In the foreign economy n^*, with $0 < n^* < 1$, denotes the share of foreign-produced traded goods in the overall basket of traded goods. The consumption bundles C_H^j and C_F^j are composed by the continuum of differentiated traded goods produced respectively in region H and F and are defined as

$$C_H^j \equiv \left[\gamma^{-\frac{1}{\sigma}}\int_0^{\gamma} c^j(h)^{\frac{\sigma-1}{\sigma}}dh\right]^{\frac{\sigma}{\sigma-1}}, \quad C_F^j \equiv \left[\gamma^{*-\frac{1}{\sigma}}\int_0^{\gamma^*} c^j(f)^{\frac{\sigma-1}{\sigma}}df\right]^{\frac{\sigma}{\sigma-1}}$$

where $\sigma > 1$ is the elasticity of substitution among the differentiated goods. Similarly, C_N^j is the home consumption index of the continuum of differentiated non-traded goods:

$$C_N^j \equiv \left[(1-\gamma)^{-\frac{1}{\sigma}}\int_{\gamma}^{1} c_N^j(h)^{\frac{\sigma-1}{\sigma}}dh\right]^{\frac{\sigma}{\sigma-1}},$$

with the same elasticity of substitution σ. In country F, γ^* replaces γ in the consumption bundles of non-traded goods.

Given the above consumption indices, we can derive the appropriate price indices. With respect to the general consumption index, we obtain the consumption-based price index P

$$P = \left[\omega(P_T)^{1-\varphi} + (1-\omega)(P_N)^{1-\varphi}\right]^{\frac{1}{1-\varphi}},$$

where *PT* and *PN* are given by

$$P_N = \left[(1-\gamma)^{-1}\int_{\gamma}^{1} p_N(h)^{1-\sigma}dh\right]^{\frac{1}{1-\sigma}},$$

while *PH* and *PF* are given by

$$P_H = \left[\gamma^{-1}\int_{0}^{\gamma} p(h)^{1-\sigma}dh\right]^{\frac{1}{1-\sigma}}, \qquad P_F = \left[\gamma^{*-1}\int_{0}^{\gamma^*} p(f)^{1-\sigma}df\right]^{\frac{1}{1-\sigma}},$$

where $p(h)$, $p(f), p_N(h)$ are respectively the prices in the common currency faced by households in country *H* for a generic home-produced traded good, a foreign-produced traded good and a domestic non-traded good. Similar indices are derived for country *F* with the appropriate modifications of the respective shares. Prices faced by foreign consumers are denoted with asterisks.

Given the consumption-based price indexes the generic home consumer j has the following demand of each of the home-produced traded goods

$$c^j(h) = \frac{n\omega}{\gamma}\left(\frac{p(h)}{P_H}\right)^{-\sigma}\left(\frac{P_H}{P_T}\right)^{-\theta}\left(\frac{P_T}{P}\right)^{-\varphi}C^j,$$

for $0 \leq h < \gamma$; of each of the foreign-produced traded goods

$$c^j(f) = \frac{(1-n)\omega}{\gamma^*}\left(\frac{p(f)}{P_F}\right)^{-\sigma}\left(\frac{P_F}{P_T}\right)^{-\theta}\left(\frac{P_T}{P}\right)^{-\varphi}C^j,$$

for $0 \leq f < \gamma$ and of each of the home-produced non-traded goods

$$c_N^j(h) = \frac{1-\omega}{1-\gamma}\left(\frac{p_N(h)}{P_N}\right)^{-\sigma}\left(\frac{P_N}{P}\right)^{-\varphi}C^j,$$

for $\gamma \leq h \leq 1$. Similar demands hold in the foreign economy.

Households get disutility from supplying labor to all the irms operating in their country of residence. In particular the function *V* (:) is increasing and convex in an index of labor L^j. Each firm uses a specific labor factor and each household can supply all the varieties of labor used in the country to produce the continuum of traded and non-traded goods. In particular each household supplies a measure one of labor varieties, of which a fraction γ will be employed in the traded sector ($\gamma^*$is the respective fraction in the foreign economy) and the remaining respective fractions in the non-traded sector. In particular we assume that L^j is a Dixit-Stiglitz aggregator of labor indices L_T and L_N in the traded and non-traded sectors, respectively, as it follows

$$L^j \equiv \left[\gamma^{\frac{1}{\phi}}(L_T^j)^{\frac{\phi-1}{\phi}} + (1-\gamma)^{\frac{1}{\phi}}(L_N^j)^{\frac{\phi-1}{\phi}}\right]^{\frac{\phi}{\phi-1}},$$

where $\phi > 0$ is the elasticity of substitution between labor in the traded and non-traded sector and L_T^j and L_N^j are composite index of the continuum of varieties supplied in both sectors

$$L_T^j \equiv \left[\gamma^{-\frac{1}{\upsilon}}\int_0^\gamma l_T^j(i)^{\frac{\upsilon-1}{\upsilon}}di\right]^{\frac{\upsilon}{\upsilon-1}}, \qquad L_N^j \equiv \left[(1-\gamma)^{-\frac{1}{\upsilon}}\int_\gamma^1 l_N^j(i)^{\frac{\upsilon-1}{\upsilon}}di\right]^{\frac{\upsilon}{\upsilon-1}},$$

where $\upsilon > 0$ is the elasticity of substitution between varieties of labor within a sector. In contrast with standard models of traded and non-traded production, we are not necessarily assuming that labor is perfectly substitutable and mobile across sectors and instead we allow for wage differentiation across varieties of labor. The case of perfect substitutability, and perfect labor mobility, is nested under the assumption that both ϕ, $\upsilon \to \infty$. In general, given wages $w_T(i)$ and $w_N(i)$ specific to the generic variety i in the respective traded and non-traded sector, we can write the following wage indexes associated with the above defined labor indices

$$W = \left[\gamma W_T^{1-\phi} + (1-\gamma)W_N^{1-\phi}\right]^{\frac{1}{1-\phi}},$$

$$W_T = \left[\gamma^{-1}\int_0^\gamma w_T^{1-\upsilon}(i)di\right]^{\frac{1}{1-\upsilon}}, \qquad W_N = \left[(1-\gamma)^{-1}\int_\gamma^1 w_N^{1-\upsilon}(i)di\right]^{\frac{1}{1-\upsilon}}.$$

Given the relative wages and the choice of L^j, we can then characterize the household´s labor decisions in the following way

$$l_T^j(h) = \left(\frac{w_T(h)}{W_T}\right)^{-\upsilon}\left(\frac{W_T}{W}\right)^{-\phi}L^j, \quad l_N^j(i) = \left(\frac{w_N(i)}{W_N}\right)^{-\upsilon}\left(\frac{W_N}{W}\right)^{-\phi}L^j,$$

for each variety of labor supplied to a generic irm in a traded and non-traded sector, respectively.

Each household faces the following flow budget constraint

$$B_t^j \leq A_t^j + W_t L_t^j + \Pi_t^j - P_t C_t^j + T_t^j \tag{2}$$

where A_t^j represents the beginning-of-period wealth that includes the bonds carried from the previous period. B_t^j is the end-of period portfolio that includes a wide selection of instruments that pay in each contingency that occurs. In particular they pay A_t in the particular contingency at date t. As of time $t-1$, A_t is a random variable whose realization depends on the state of nature at time t.

Here it is assumed that there are complete financial market which

implies that there exists a unique discount factor $Q_{t,t+1}$ with the property that the price in period t of a portfolio with random value A_{t+1} is

$$B_t = E_t[Q_{t,t+1}A_{t+1}],$$

where E_t denotes the expectation conditional on the state of nature at date t. In particular we define the short-term interest rate in the following way, as the price of the portfolio that delivers one unit of currency in each contingency that occur one-period ahead, i.e.

$$\frac{1}{1+i_t} = E_t[Q_{t,t+1}].$$

In (2), Π_t are aggregate pro.ts of all the irms within a country. Pro.ts are risk shared across households. T_t^j are transfers from the government to household j. The economy is a cashless- limiting monetary economy as discussed in Woodford (2003). The flow budget constraint of the consumer can be written as

$$E_t[Q_{t,t+1}A_{t+1}^j] \leq A_t^j + W_t L_t^j + \Pi_t^j - P_t C_t^j + T_t^j$$

and the consumer.s problem is further subject to the following borrowing limit condition in each contingency and date that the consumer faces.

$$A_{t+1}^j \geq -\sum_{s=t+1}^{\infty} E_{t+1}Q_{t+1,s}\{W_s L_s^j + \Pi_s^j + T_s^j\} > -\infty.$$

The borrowing limit condition together with the flow budget constraint imply the standard in- tertemporal budget constraint

$$\sum_{s=t}^{\infty} E_t Q_{t,s}\left[P_s C_s^j\right] \leq A_t^j + \sum_{s=t}^{\infty} E_t Q_{t,s}\left[W_s L_s^j + \Pi_s^j + T_s^j\right]. \quad (3)$$

Given the above decisions on how to allocate consumption and labor across all the varieties, the household j chooses the optimal path of the consumption index C_t and labor index L_t at all times and contingencies to maximize its utility under the intertemporal budget constraint. In particular the set of optimality conditions can be described by the set of Euler conditions

$$\frac{U_c(C_t^j)}{U_c(C_{t+1}^j)} = \frac{\beta}{Q_{t,t+1}}\frac{P_t}{P_{t+1}} \quad (4)$$

for each state of nature at time $t+1$ looking ahead from time t

By choosing appropriately the distribution of initial state-contingent wealth, complete markets assure that consumption is perfectly equalized within households belonging to a country. Moreover, across countries, the ratio of marginal utilities of consumption is proportional to the ratio of consumer prices:

$$\frac{U_c(C_t)}{U_c(C_t^*)} = \varsigma \frac{P_t}{P_t^*} \tag{5}$$

for a positive factor of proportionality $\varsigma > 0$ which again depends on the initial wealth distribution. As shown by Backus and Smith (1993), under the assumption of complete .nancial markets, consumer-price differentials directly translate into consumption differentials, so that a country which experiences an increase in its consumer price level relative to another country should experience a fall in its own consumption relative to the other country. This complete-market assumption is a convenient simpli.cation but it comes at a cost of neglecting wealth distribution as an important channel through which price and in.ation differentials can propagate into the economy and be amplified.

Real wages, computed using the general price and wage indices, are equated to the marginal rate of substitution between the labor index L and the consumption index C as

$$\frac{W_t}{P_t} = \frac{V_l(L_t)}{U_c(C_t)}. \tag{6}$$

Finally the last optimality condition is the exhaustion of the intertemporal budget constraint, i.e. (3) holds with equality at all times.

3.2 Firms

Regarding the supply side of the economy, we indeed assume that there is a continuum of firms, of measure one, which is producing the continuum of goods. In particular a fraction γ (γ^* in the foreign economy) is producing traded goods, while the remaining fractions are producing non-traded goods. Taking as representative the home economy, a generic irm producing in the traded sector is using the following technology $y^T(h) = A_T f(l(h))$; where A_T is a country- and sector- specific technological shock and $f(:)$ is a standard concave production function in the specific variety of labor used in the production of good h.[13] In the non-traded sector the technology is

given $y^N(h) = A_N f(l(h))$ for a generic firm h in the non-traded sector: Firms in both sectors are monopolist and set their prices considering the overall demand of their goods. In the traded sector, we assume that there is no price discrimination and that all the consumers of the area face the same price for the same variety of goods. In particular in the traded sector a generic firm h faces the following demand

$$y^T(h) = \frac{n\omega}{\gamma}\left(\frac{p(h)}{P_H}\right)^{-\sigma}\left(\frac{P_H}{P_T}\right)^{-\theta}\left(\frac{P_T}{P}\right)^{-\varphi} C + \frac{n^*\omega^*}{\gamma}\left(\frac{p(h)}{P_H}\right)^{-\sigma}\left(\frac{P_H}{P_T^*}\right)^{-\theta}\left(\frac{P_T^*}{P^*}\right)^{-\varphi} C^*$$

In the non-traded sector, a generic irm faces the following demand

$$y^N(h) = \frac{1-\omega}{1-\gamma}\left(\frac{p_N(h)}{P_N}\right)^{-\sigma}\left[\left(\frac{P_N}{P}\right)^{-\varphi} C_N + G\right],$$

where in particular G is an exogenous country-speci.c government-purchase shock that affects only the demand of non-traded goods. Period profits for a generic firm h in the traded sector are given by

$$\pi_{T,t} = [(1-\tau_{T,t})p_t(h)y_t^T(h) - w_t(h)l_t(h)], \tag{7}$$

where $\tau_{T,t}$ is a sectorial country-specific time-varying proportional tax on sales in the traded sector, $p_t(h)$ denotes the price of the firm h chosen at date t and $y_t^T(h)$ is the total demand of firm h at time t . As standard in models with monopolistic competition, profit maximization leads to the condition that prices are set as mark-up over nominal marginal costs

$$p_t(h) = \mu_{T,t} MC_t^T(h),$$

where

$$\mu_{T,t} \equiv \frac{\sigma}{(1-\tau_{T,t})(\sigma-1)}$$

and the nominal marginal cost of firm h are given by

$$\begin{aligned} MC_t^T(h) &\equiv \frac{w_{T,t}(h)}{f'(f^{-1}(y_t^T(h)/A_{T,t}))A_{T,t}} \\ &= \mu_{T,t} W_t \left(\frac{W_{T,t}}{W_t}\right)^{1-\frac{\phi}{v}} \left(\frac{f^{-1}[(y_{t,s}^T(h)/A_{T,t}]}{L_t}\right)^{-\frac{1}{v}} \frac{1}{f'(f^{-1}(y_t^T(h)/A_{T,t}))A_{T,t}} \end{aligned}$$

All firms within a sector set the same price. It follows that the supply schedule in the traded sector of the domestic economy implies that

13. When *f*(:) has decreasing return to scale with respect to labor, we are implicitly assuming that there is a fixed factor of production, capital, which is not mobile across sectors.

$$1 = \mu_{T,t} \frac{P_t}{P_{T,t}} \frac{P_{T,t}}{P_{H,t}} \frac{V_l(L_t)}{U_c(C_t)} \left(\frac{l_{T,t}}{L_t}\right)^{-\frac{1}{\phi}} \frac{1}{f'(l_{T,t})A_{T,t}}.$$

As well, we obtain that in the traded sector of country F

$$1 = \mu^*_{T,t} \frac{P^*_t}{P^*_{T,t}} \frac{P^*_{T,t}}{P_{F,t}} \frac{V_l(L^*_t)}{U_c(C^*_t)} \left(\frac{l^*_{T,t}}{L^*_t}\right)^{-\frac{1}{\phi}} \frac{1}{f'(l^*_{T,t})A_{T,t}}.$$

In the non-traded sectors, respectively in country H and F, we obtain that

$$1 = \mu_{N,t} \frac{P_t}{P_{N,t}} \frac{V_l(L_t)}{U_c(C_t)} \left(\frac{l_{N,t}}{L_t}\right)^{-\frac{1}{\phi}} \frac{1}{f'(l_{N,t})A_{N,t}},$$

$$1 = \mu^*_{N,t} \frac{P^*_t}{P^*_{N,t}} \frac{V_l(L^*_t)}{U_c(C^*_t)} \left(\frac{l^*_{N,t}}{L^*_t}\right)^{-\frac{1}{\phi}} \frac{1}{f'(l^*_{N,t})A^*_{N,t}},$$

where $\mu^*_{T,t}$, $\mu_{N,t}$ and $\mu^*_{N,t}$ have been appropriately defined.

3.3 Fiscal and Monetary Policies

Each country has its own .scal authority while there is a single monetary policymaker for the whole area. In each region, the government raises revenues from the distortionary sale taxes to finance the expenditure for domestic non-traded goods. Moreover, lump-sum taxes are available to balance the budget in each period. It follows that

$$\begin{aligned} 0 &= \int_\gamma^1 p_{N,t}(h) g_t(h) dh + \int_0^1 T^j_t dj - \tau_{N,t} \int_\gamma^1 p_{N,t}(h) y^N_t(h) dh \\ &\quad - \tau_{T,t} \int_0^\gamma p_t(h) y^T_t(h) dh \end{aligned}$$

for country H while

$$\begin{aligned} 0 &= \int_{\gamma^*}^1 p^*_{N,t}(f) g^*_t(f) df + \int_0^1 T^{*j}_t dj - \tau^*_{N,t} \int_{\gamma^*}^1 p^{N*}_t(f) y^*_{N,t}(f) df \\ &\quad - \tau^*_{T,t} \int_0^{\gamma^*} p^*_t(f) y^*_t(f) df \end{aligned}$$

for country F; where T^{*j}_t and T^j_t are lump-sum transfers to households in countries H and F respectively. Given the full flexibility of prices monetary policy is just needed for nominal anchor.

The Appendix at the end describes in details the solution to the model.

4 EQUILIBRIUM PRICE DIFFERENTIALS

We can write the ratio of the CPI prices of the two countries in the following way

$$\frac{P_t}{P_t^*} = \frac{P_{T,t}}{P_{T,t}^*} \frac{[\omega + (1-\omega)T_{N,t}^{1-\varphi}]^{\frac{1}{1-\varphi}}}{[\omega^* + (1-\omega^*)T_{N,t}^{*1-\varphi}]^{\frac{1}{1-\varphi}}}$$

where we have de.ned the relative price of non-traded with respect to traded goods in each country as $T_N \equiv P_N/P_T$ and $T_N^* \equiv P_N^*/P_T^*$ The ratio of the tradeable goods prices is instead given by

$$\frac{P_{T,t}}{P_{T,t}^*} = \frac{[nP_{H,t} + (1-n)P_{F,t}]^{\frac{1}{1-\theta}}}{[n^*P_{F,t}^* + (1-n^*)P_{H,t}^*]^{\frac{1}{1-\theta}}}.$$

There can be several possible ways through which differences in consumer prices can arise among countries. One obvious reason has to do with the different composition of the consumption indices, due to differences in tastes. This can happen either because there can be home bias in the consumption of traded good, so that $n^* \neq 1-n$ or because the share of traded goods in the overall consumption basket can vary across countries, $\omega \neq \omega^*$. Heterogeneity in consumption preferences can be a source of consumer-price differentials even if the prices of all the goods, traded and non-traded, are equalized across countries. Conversely, even if tastes are similar, price differentials at the single good level can produce differential at the consumer-price level. The above decomposition shows that this can happen either because of deviations from the law of one price for traded goods or because relative price of non-traded goods can vary across countries.

The issue of explaining consumer price differential in a currency area is closely related to a long-lasting puzzle in the international finance literature: the PPP puzzle and the related literature on real exchange rate behavior.[14] Using the above decomposition, Engel (1999) has studied the US real exchange rate relative to several countries and shown that its variability can be accounted mostly by the variability of the deviations from the law of one price for traded goods relative to the variability of the relative price of non-traded goods. With multiple currencies, firrms might set their prices sticky in the currency of the buyer, hence protecting consumers from fluc-

14. See Rogoff (1996).

tuations of the exchange rate. In this way deviations from the law of one price for traded goods reflect mostly fluctuations of the nominal exchange rate. This interpretation is naturally absent in a currency area, since there is no reason to protect prices from fluctuations of the nominal exchange rate.[15]

However, a unique currency does not exclude the possibility for irms to price discriminate across different markets (countries) due to different degrees of competition in the markets or structural characteristics.

Moreover, even if irms do not price discriminate and markets are characterized by similar structures and degrees of competition, there can be price deviations for traded goods that enter the consumption basket, stemming from the fact that traded goods usually carry some non-traded components (e.g. distribution costs) before reaching the consumer markets.[16] Sondergaard (2003) using input-output tables for France, Italy and Spain has shown that the traded sector relies more than others on intermediate inputs produced by other sectors in the economy; in particular total inputs from other sectors account for 60 percent of gross output in the traded sector. Movements in the prices of non-traded goods that enter in the production or transportation of traded goods can be an important source of price dispersion for traded goods at the consumer level. Our evidence shows that in.ation dispersion in the traded sector is much lower than in the non- traded sector, which suggests that in any case differences in the relative price of non-traded goods can be much more important in explaining the consumer price differential.

In this work, we choose not to model any price differential in the traded sector to get more insight on what we believe can be a stronger channel.[17] We assume that there is no price discrimination and

15. A puzzling finding of Engel (1999) is that the importance of the relative price of traded goods in explaining the variability of the real exchange rate is robust across the .xed exchange rate period of Bretton Woods and the following floating exchange rate period. This decomposition holds in general also for developing economies, as in the case of Mexico studied by Engel (2001). However in this case Mendoza (2000) has shown that during periods of fixed-exchange rate regime movements in the relative price of non-traded goods are dominant in explaining real exchange rate volatility. In relation to the debate on whether deviations from the law of one price for tradeable goods originate from local currency pricing, works by Obstfeld and Rogoff (2000) and Campa and Goldberg (2002) have emphasized that the pass-through of the exchange rate at the border level can be high.

16. The importance of distribution sectors in explaining differential at the consumer-price leve has been emphasized by Burstein et al. (2003) and Corsetti and Dedola (2004).

17. Andres et al. (2003) acknowledge the importance of the relative price of non-traded goods but they focus on differentials that arise from price discrimination in the traded-good sector.

that $P_H = P_H^*$ and $P_F = P_F^*$ at all times. We also assume perfect symmetry across countries and sectors and set $\omega = \omega^* = \gamma = \gamma^*$ and $n = n^* = 1/2$. It further follows that $P_T = P_T^*$.. In the appendix, we solve the model by taking a log-linear approximation to the relevant structural equilibrium conditions around a deterministic steady state in which the shocks to mark-ups, productivity and government expenditures, i.e. $\mu_{T,t}$, $\mu_{T,t}^*$, $\mu_{N,t}$, $\mu_{N,t}^*$, $A_{T,t}$, $A_{T,t}^*$, $A_{N,t}$, $A_{N,t}^*$, G_t, G_t^* are such that $\bar{\mu}_T = \bar{\mu}_T^* = \bar{\mu}_N = \bar{\mu}_N^* = \bar{\mu}$ and $\bar{A}_T = \bar{A}_T^* = \bar{A}_N = \bar{A}_N^* = \bar{A}$, $\bar{G} = \bar{G}^* = 0$. In a log-linear approximation around this steady state the consumer-price differential is proportional to the non-traded goods price differential (all in logs)

$$\begin{aligned} \ln P_t - \ln P_t^* &= (1-\gamma)(\hat{T}_{N,t} - \hat{T}_{N,t}) \\ &= (1-\gamma)(\ln P_{N,t} - \ln P_{N,t}^*), \end{aligned}$$

where hat variables represent log-deviations of the respective variable from the steady state.

The most popular and often advocated reason for why there can be long-lasting departures from PPP originating from non-traded goods prices is due to Balassa (1964) and Samuelson (1964). According to this view, countries that experience higher productivity growth in the traded sector will also show higher consumer prices. The reason is that productivity growth in the traded sector translates into an increase in the overall wage in the economy, since prices of traded goods are tied internationally and there is perfect labor mobility. In the non-traded sector, irm will increase their prices since costs have increased and there are no benefits from productivity gains.

There are several assumptions needed to get this result, as discussed in Froot and Rogoff (1995): mobility of labor and capital across sectors and mobility of capital internationally, constant returns to scale in the mobile factors and exogenous world real interest rate. Indeed, we cannot expect our model to display the Balassa-Samuelson features since capital is constant in each sector and labor is not perfectly mobile. Moreover, as shown in recent works by Benigno and Thoenissen (2003), Cova (2003), Duarte and Wolman (2003), Fitzgerald (2002), MacDonald and Ricci (2002), the assumption of homogenous traded-good market is critical for the Balassa-Samuelson result to hold. In our model, each country is specialized in the production of a bundle of traded goods. When the traded sector of a country is subject to a productivity shock, prices of home-produced traded goods can fall with respect to foreign-produ-

ced traded goods and terms of trade worsen. In this case movements in terms of trade can absorb the productivity shock and reduce the pressure on wages and then on non-traded goods prices.

Another feature of the Balassa-Samuelson framework is that the consumer-price differential depends only on the supply-side structure of the model. Instead in our framework, as in Rogoff (1992), a model no capital mobility and low labor mobility can also capture additional sources of price differentials driven by demand shocks.[18] This is also the case in a more modern exposition of the Balassa-Samuelson model as in Canzoneri et al. (2001). We add also sectorial mark-up shocks to study whether changes in taxation and competition can account for consumer-price differences.

To get further insight into the model, we assume that the production functions are linear in the only factor of production, labor. In the appendix, we show that under this assumption the log of the terms of trade and the log difference of non-traded goods prices are determined by the following two equations

$$\ln P_{N,t}/P^*_{N,t} = -\frac{\left(1-\frac{\theta}{\phi}\right)}{\left(1-\frac{b}{\phi}\right)}\hat{T}_t - \frac{1}{\left(1-\frac{b}{\phi}\right)\phi}\hat{G}^R_t + \frac{\left(1-\frac{1}{\phi}\right)}{\left(1-\frac{b}{\phi}\right)}(\hat{A}^R_{T,t}-\hat{A}^R_{N,t}) - \frac{1}{\left(1-\frac{b}{\phi}\right)}(\hat{\mu}^R_{T,t}-\hat{\mu}^R_{N,t}) \quad (8)$$

$$\begin{aligned}\left[1+\left(\eta+\frac{1}{\phi}\right)\theta\gamma-\frac{\theta}{\phi}\right]\hat{T}_t &= \left(\eta+\frac{1}{\phi}\right)b(1-\gamma)(\ln P_{N,t}/P^*_{N,t}) + \left(1-\frac{1}{\phi}\right)\hat{A}^R_T \\ &\quad -\hat{\mu}^R_T + \left(\eta+\frac{1}{\phi}\right)[\gamma\hat{A}^R_T + (1-\gamma)\hat{A}^R_N] \\ &\quad -\left(\eta+\frac{1}{\phi}\right)(1-\gamma)\hat{G}^R_t \end{aligned} \quad (9)$$

where the log of the terms of trade is de.ned as $\hat{}_t \equiv \ln P_{F,t}/P_{H,t}$ and where $b \equiv \varphi\gamma + (1-\gamma)\rho^{-1}$; η –the inverse of the elasticity of labor supply– is defined as $\eta \equiv \bar{V}_{ll}\bar{L}/\bar{V}_l$, ρ –the risk-aversion coefficient- is given by $\rho \equiv \bar{U}_{cc}\bar{C}/\bar{U}_c$ and an upper index R denotes the difference between the home and the foreign respective variable. First, we simplify the analysis by assuming perfect labor mobility, $\phi \to \infty$, and we combine (8) and (9) to obtain

$$\begin{aligned}\ln P_{N,t}/P^*_{N,t} &= \frac{(\theta-1)\gamma\eta}{(1+\theta\gamma\eta+\eta b(1-\gamma))}\hat{A}^R_{T,t} - \frac{[1+\theta\gamma\eta+\eta(1-\gamma)]}{(1+\theta\gamma\eta+\eta b(1-\gamma))}\hat{A}^R_{N,t} + \\ &\quad -\frac{\theta\gamma\eta}{(1+\theta\gamma\eta+\eta b(1-\gamma))}\hat{\mu}^R_{T,t} + \frac{\eta(1-\gamma)}{(1+\theta\gamma\eta+\eta b(1-\gamma))}\hat{G}^R_t \\ &\quad +\frac{(1+\theta\gamma\eta)}{(1+\theta\gamma\eta+\eta b(1-\gamma))}\hat{\mu}^R_{N,t}.\end{aligned}$$

18. De Gregorio et al. (1994) find evidence that demand shocks can be important in explaining deviations from PPP. As well, Froot and Rogoff (1991) .nd that government spending can be an important explanatory variable for real exchange rate movements of several European countries in the EMS.

The above equation shows the determination of non-traded goods price differential as a function of the shocks of the economy. When the intratemporal elasticity of substitution, θ, is close to one then an increase in the productivity of the home traded sector does not increase in a signifficant way the non-traded good price and thus the consumer price in the home economy. Contrary to the Balassa-Samuelson result, a balanced productivity shock in all the sectors within a country creates a major reduction in the domestic consumer price. A relative increase in government spending in the domestic economy increases price differentials across countries. The reason is that government spending falls on non-traded goods and induces an increase in their prices. Mark-up shocks in the non-traded sector increase price differential; the opposite happens if they originate in the traded sector. A balanced mark-up shock in the domestic economy increases the price differential. In the limiting case in which domestic and foreign traded goods become perfectly substitutable (as in the Balassa-Samuelson hypothesis), i.e. θ goes to in.nity, then the above solution collapses to

$$\ln P_{N,t}/P^*_{N,t} = \hat{A}^R_{T,t} - \hat{A}^R_{N,t} + \hat{\mu}^R_{N,t} - \hat{\mu}^R_{T,t}$$

which captures now the Balassa-Samuelson result augmented with mark-up shocks. Note that in this limiting case, demand shocks and balanced shocks do not matter.[19] Our results on the role of the elasticity of substitution between domestic and foreign traded goods in driving the Balassa- Samuelson effect are consistent with the numerical findings of Duarte and Wolman (2003).

Another illustrative case is when $\varphi = \theta = \rho = 1$. Under this assumption we obtain

$$\begin{aligned}\ln P_{N,t}/P^*_{N,t} &= -\frac{(\phi\eta+1)\,\gamma}{(\phi-1)\,(1+\eta)}\hat{\mu}^R_{T,t} - \hat{A}^R_{N,t} + \frac{(1+\phi\eta)(\phi(1-\gamma)-1)-(\phi-1)}{(\phi-1)\phi(1+\eta)}\hat{G}^R_t \\ &\quad + \frac{[\phi+(\phi\eta+1)\,\gamma-1]}{(\phi-1)\,(1+\eta)}\hat{\mu}^R_{N,t}.\end{aligned}$$

Now, the Balassa-Samuelson effect is completely muted and, most important, values of ϕ below one can change the sign of some of the responses as well as the magnitude.

We now go back to our more general model and calibrate it in

19. As discussed in Froot and Rogoff (1995), balanced productivity shocks can matter when labor intensity differs across sectors.

order study which of the shocks in the model can be more relevant to explain price differential.

Table 1:
Calibration of the parameters

$\beta = 0.99$	Intertemporal discount factor in consumer preferences
$\rho = -\bar{U}_{cc}\bar{C}/\bar{U}_c = 2$	Risk aversion coefficient in consumer preferences
$\varphi = 0.44$	Elas. of substitution between traded and non-traded goods
$\theta = 1.5$	Elas. of substitution between domestic and foreign traded goods
$\sigma = 7.88$	Elas. of substitution across goods within a sector
$\gamma = 0.5$	Share of traded goods in the consumption bundle
$\eta = \bar{V}_{ll}\bar{L}/\bar{V}_l = 0.25$	Inverse of the Frisch elasticity of labor supply
$\lambda = \bar{f}'\bar{l}/\bar{f} = 0.75$	Labor share
$1 - \tilde{\lambda} = -\bar{f}''\bar{l}/\bar{f}' = 0.25$	Curvature of the production function

Table 1 presents the calibration of the parameters. The coefficient of risk aversion in consumer preferences is set to 2 as in Stockman and Tesar (1995) to get an intertemporal elasticity of substitution equal to 0.5. From Stockman and Tesar (1995), we borrow also the elasticity between traded and non-traded goods, $\varphi = 0{:}44$; and the share of traded goods in the consumption basket, $\gamma = 0{:}5$. The intra-temporal elasticity of substitution between home and foreign traded goods is set such that $\theta = 1{:}5$ as in Backus et al. (1995). Consistent with several microeconomic studies, the Frisch elasticity of labor supply, $1/\eta$, is set to 4 and the labor share is set such that $\lambda = 0{:}75$: The discount factor β is assumed to be 0.99 and the elasticity of substitution for goods within a sector, σ, is set to 7:88 to imply a 15% mark-up as in Rotemberg and Woodford (1997). Furthermore, we assumed that in steady state the government expenditure is 20% of total output. We are not calibrating the parameter ϕ which measures the degree of labor mobility across sectors. Instead, we discuss three possible cases, $\phi = \infty$, which captures the perfect labor mobility case, an intermediate case of $\phi = 4{:}5$ and a case with low elasticity; $\phi = 0{:}5$.

With flexible prices, the real variables of the model inherit the stochastic properties of the shocks. There is no intrinsic persistence in the model. Then, Table 2 captures short- and long-run components of consumer price differentials. In particular we show the response of the consumer in.ation differential and the terms of trade to a 1% increase of the shocks that are in the model. We also describe the res-

ponse of terms of trade to capture the dimension through which movements in terms of trade absorb the usual Balassa-Samuelson effect. Focusing on the perfect labor mobility case, we see that a 1% increase in the traded-sector productivity in the home country does increase the price differential only of 2 basis point, consistent with the results of Duarte and Wolman (2003). The terms of trade worsen to absorb most of the shock. Instead an increase in productivity in the non-traded sector and a balanced increase in productivity in the domestic economy lower the domestic consumer price with respect to the foreign. In the same way, terms-of-trade movements absorb mark-up shocks in the traded-sector with negligible spillover on consumer prices, while mark-up shocks in the non-traded sector produce increases in prices. Government-purchase shocks that affect demand of non-traded goods increase the non- tradeable goods price and thus the overall consumer price level. With intermediate values of the labor-mobility parameter, the picture does no change much. On the opposite, when ϕ goes below the unitary value, most of the responses are ampli.ed and some change sign. Most important, the impact of government-spending shocks is of larger magnitude.

Table 2:
Impulse Response

	$\phi \to \infty$		$\phi = 4.5$		$\phi = 0.5$	
1% shock to:	$\pi - \pi^*$	$\frac{P_H}{P_F}$	$\pi - \pi^*$	$\frac{P_H}{P_F}$	$\pi - \pi^*$	$\frac{P_H}{P_F}$
$\hat{A}_T$	0.02	0.85	0.04	0.89	-0.21	0.55
$\hat{A}_N$	-0.60	0.04	-0.55	0.09	-0.98	-0.46
$\hat{A}_T$ and $\hat{A}_N$	-0.58	0.89	-0.51	0.98	-1.19	0.09
$\hat{\mu}_T$	-0.05	-0.57	-0.13	-0.67	0.64	0.35
$\hat{\mu}_N$	0.40	0.03	0.44	0.08	0.07	-0.40
$\hat{\mu}_T$ and $\hat{\mu}_N$	0.35	-0.54	0.31	-0.59	0.71	-0.05
$\hat{G}_t$	0.19	-0.07	0.11	-0.18	0.91	0.86

5 VARIANCE DECOMPOSITION OF THE INFLATION DIFFERENTIAL

The previous section has analyzed the extent to which various structural shocks may generate inflation differentials, which are found to be sizeable in the case of some of the shocks for a plausible parametrization of the model. We now turn to evaluating the proportion to which each of the shock contributes to the overall variability

of the inflation differential implied by our model. In order to perform the variance decomposition exercise, we need to specify and calibrate the stochastic properties of all the shocks considered in the model. While a fully fledged exercise would require the estimation of all the model parameters, here we resort to a simpler analytical approach, assuming that the shocks to productivity, the mark-up and government expenditure mimic the respective ones estimated by Smets andWouters (2003), once aggregated across sectors and countries.

Starting from the productivity shock, we assume that each one of the four productivity shocks, $\{A_{T,t}, A_{N,t}, A^*_{T,t}, A^*_{N,t}\}$, follows independent $AR(1)$ process with lag coefficient of 0:823 and standard error of the innovation of 0:012; this ensures that the aggregate productivity, resulting from the weighted average of the countries/sectoral ones, exactly matches the process estimated by Smets and Wouters (2003).

The shocks to government expenditure in each country are assumed to follow the same independent and very persistent $AR(1)$ process with coefficient on the lag term of 0:949 and standard deviation of the innovation of 0:0046.

Finally, for the mark-up shocks, we impose that they are common between tradable and non-tradable sectors in each economy and we also assume the same process for both economies but uncorrelated across economies. Furthermore, we impose that mark-ups are white noise processes with a standard deviation of 0:0066; in order to match the overall variability of the price and wage mark-up shocks of Smets and Wouters (2003).

While the present calibration is admittedly ad hoc, it nonetheless provides some hints on the way in which different shocks contribute to the dynamic decomposition of the variance. Table 3 present the unconditional variance for several variables of the model. In particular the first column considers the CPI inflation differential. We also present the fraction of the total variance to which each shock contributes for each of the respective variables.

Focusing on the CPI inflation differential we note that the long-run variance is equal to 0:0020 which implies a standard deviation of 0:44% at quarterly frequency which roughly corresponds to a standard deviation of 0:90% yearly.[20] From Table 3, productivity shocks that affect the traded sector in general do not contribute much to the variability of the inflation differential, since they are absorbed by

Table 3:
Variance decomposition

		$\pi - \pi^*$	$\frac{P_H}{P_F}$	$\frac{P_N}{P_N^*}$	$Y - Y^*$	$\frac{W}{P}$	$\frac{W^*}{P*}$
Variance		0.002	0.021	0.016	0.033	0.012	0.012
	$\hat{A}_T$	0.00	0.49 0	00	0.41	0.17	0.15
	$\hat{A}_N$	0.44	0.00	0.49	0.07	0.63	0.01
	$\hat{A}_T^*$	0.00	0.49	0.00	0.41	0.15	0.17
Shocks	$\hat{A}_N^*$	0.44	0.00	0.49	0.07	0.01	0.63
(fractions of variance)	$\hat{\mu}$	0.06	0.01	0.01	0.01	0.03	0.01
	$\hat{\mu}^*$	0.06	0.01	0.01	0.01	0.01	0.03
	$\hat{G}$	0.00	0.00	0.00	0.01	0.00	0.00
	$\hat{G}^*$	0.00	0.00	0.00	0.01	0.00	0.00

movements in the terms of trade .indeed productivity shocks in the traded sector are responsible for most of the volatility in the terms of trade. Most important, productivity shocks in the traded sector explain the bulk of the variability of the output differential across countries.

By contrast, inflation differentials are mainly driven by productivity shocks affecting the non-tradable sector, and to a lower extent by mark-ups shocks. Productivity shocks in the non-tradable sector are also the main factor behind the variability of real wages. Interestingly, government-purchase shock do not contribute signi.cantly to the variability of the variables displayed in the table. For government-purchase shocks, the results are in line with Duarte and Wolman (2003).

While it is not easy to draw a clear link between the results of the factor analysis in Section 2 and the variance decomposition exercise, a plausible interpretation of this evidence is to associate those underling statistical factors, identi.ed in Section 2 for the euro area, with countries and/or sectorial productivity dynamics. However a clear investigation of those links is beyond the scope of this work.[21]

20. To convert on a yearly base, we multiplied the quarterly variance by a factor of four. This clearly understates the yearly variance because it amounts at assuming that the quarterly changes are independent over time.

21. Such investigation is currently hampered, notably, by the limited time span of euro area data, which makes difficult to address for the moment empirical issues on long-run determinants of inflation differentials.

6 Conclusions

This paper provides both an empirical and a theoretical analysis of the factors accounting for persistent inflation differentials in a monetary union comprised of heterogenous regions. Our results indicate that asymmetric productivity shocks in the non-traded sector account for a significant fraction of the variability in the relative CPI across the two countries. Moreover, we find that symmetric sectorial productivity shocks in one country may generate sizeable inflation differentials. This stands in contrast to the conventional explanation of movements in the real exchange rate, which had pointed to movements in relative productivity in the traded sector.

This concluding Section discusses some possible avenues for future work. The model could be extended to include a third country so as to account for the component of inflation differentials that arise as a consequence of the interaction between common external shocks and the heterogeneity among euro area members in terms of their trade linkages with non-EMU partner countries. Honohan and Lane (2003, 2004) have emphasized the relevance of this source of inflation differentials in the euro area, showing that movements in national trade-weighted multilateral exchange rates are signi.cantly correlated with national inflation rates. Even if our model relates to a currency area with no external trade, the previous channel of inflation differentials stemming from common external shocks could be proxied in our framework by balanced productivity shocks which interact with heterogeneous country structures.

More importantly, introducing country and sector speci.c degrees of nominal rigidity in price setting would permit to analyze the interaction of structural shocks, asymmetric degrees of nominal rigidities and monetary policy in shaping inflation differentials. It would also permit to assess how optimal monetary policy is affected by the presence of asymmetric degrees of nominal rigidity in sectors and countries of a monetary union. We analyze these issues in Altissimo et al. (2004).

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7 APPENDIX: MODEL SOLUTION

We remind that in the traded sector of country H, the first-order conditions for price-setting behavior imply

$$1 = \mu_{T,t} \frac{P_t}{P_{T,t}} \frac{P_{T,t}}{P_{H,t}} \frac{V_l(L_t)}{U_c(C_t)} \left(\frac{l_{T,t}}{L_t}\right)^{-\frac{1}{\phi}} \frac{1}{f'(l_{T,t})A_{T,t}}; \tag{10}$$

in the traded sector of country F, we obtain that

$$1 = \mu^*_{T,t} \frac{P^*_t}{P^*_{T,t}} \frac{P^*_{T,t}}{P_{F,t}} \frac{V_l(L^*_t)}{U_c(C^*_t)} \left(\frac{l^*_{T,t}}{L^*_t}\right)^{-\frac{1}{\phi}} \frac{1}{f'(l^*_{T,t})A_{T,t}}. \tag{11}$$

In the non-traded sectors, respectively in country H and F, we obtain that

$$1 = \mu_{N,t} \frac{P_t}{P_{N,t}} \frac{V_l(L_t)}{U_c(C_t)} \left(\frac{l_{N,t}}{L_t}\right)^{-\frac{1}{\phi}} \frac{1}{f'(l_{N,t})A_{N,t}}, \tag{12}$$

$$1 = \mu^*_{N,t} \frac{P^*_t}{P^*_{N,t}} \frac{V_l(L^*_t)}{U_c(C^*_t)} \left(\frac{l^*_{N,t}}{L^*_t}\right)^{-\frac{1}{\phi}} \frac{1}{f'(l^*_{N,t})A^*_{N,t}}. \tag{13}$$

We define $T \equiv P_F/P_H$, $T_N \equiv P_N/P_T$ and $T^*_N \equiv P^*_N/P^*_T$: Note that since the law of one price holds for traded goods it follows that $P_F = P^*_F$ and $P_H = P^*_H$. Using the de.nition of the price indexes, we obtain that

$$\left(\frac{P_{H,t}}{P_{T,t}}\right)^{\theta-1} = n + (1-n)T_t^{1-\theta}, \quad \left(\frac{P_{H,t}}{P^*_{T,t}}\right)^{\theta-1} = n^* + (1-n^*)T_t^{1-\theta}, \tag{14}$$

$$\left(\frac{P_{F,t}}{P_{T,t}}\right)^{\theta-1} = nT_t^{\theta-1} + (1-n), \quad \left(\frac{P_{F,t}}{P^*_{T,t}}\right)^{\theta-1} = n^*T_t^{\theta-1} + (1-n^*), \tag{15}$$

$$\left(\frac{P_{N,t}}{P_t}\right)^{\varphi-1} = \omega T_{N,t}^{\varphi-1} + (1-\omega), \quad \left(\frac{P^*_{N,t}}{P^*_t}\right)^{\varphi-1} = \omega^* T^{*\varphi-1}_{N,t} + (1-\omega^*), \tag{16}$$

$$\left(\frac{P_{T,t}}{P_t}\right)^{\varphi-1} = \omega + (1-\omega)T_{N,t}^{1-\varphi}, \quad \left(\frac{P^*_{T,t}}{P^*_t}\right)^{\varphi-1} = \omega^* + (1-\omega^*)T^{*1-\varphi}_{N,t}. \tag{17}$$

We finally note that (17) imply

$$\frac{P_t}{P_t^*} = \frac{P_{T,t}}{P_{T,t}^*} \frac{[\omega + (1-\omega)T_{N,t}^{1-\varphi}]^{\frac{1}{1-\varphi}}}{[\omega^* + (1-\omega^*)T_{N,t}^{*1-\varphi}]^{\frac{1}{1-\varphi}}}$$

moreover (14) imply

$$\frac{P_{T,t}}{P_{T,t}^*} = \frac{[n + (1-n)T_t^{1-\theta}]^{\frac{1}{1-\theta}}}{[n^* + (1-n^*)T_t^{1-\theta}]^{\frac{1}{1-\theta}}}. \tag{18}$$

We can finally write that

$$\frac{P_t}{P_t^*} = \frac{[n + (1-n)T_t^{1-\theta}]^{\frac{1}{1-\theta}}}{[n^* + (1-n^*)T_t^{1-\theta}]^{\frac{1}{1-\theta}}} \frac{[\omega + (1-\omega)T_{N,t}^{1-\varphi}]^{\frac{1}{1-\varphi}}}{[\omega^* + (1-\omega^*)T_{N,t}^{*1-\varphi}]^{\frac{1}{1-\varphi}}}$$

which can be substituted in (5) to obtain

$$\frac{U_C(C_t)}{U_C(C_t^*)} = \frac{[n + (1-n)T_t^{1-\theta}]^{\frac{1}{1-\theta}}}{[n^* + (1-n^*)T_t^{1-\theta}]^{\frac{1}{1-\theta}}} \frac{[\omega + (1-\omega)T_{N,t}^{1-\varphi}]^{\frac{1}{1-\varphi}}}{[\omega^* + (1-\omega^*)T_{N,t}^{*1-\varphi}]^{\frac{1}{1-\varphi}}}. \tag{19}$$

We note that $L_{T,t} = \gamma l_{T,t}$ and $L_{T,t}^* = \gamma^* l_{T,t}^*$ and $L_{N,t} = (1-\gamma) l_{N,t}$ and $L_{N,t}^* = (1-\gamma^*) l_{N,t}^*$ so that

$$L_t = \left[\gamma (l_{T,t})^{\frac{\phi-1}{\phi}} + (1-\gamma)(l_{N,t})^{\frac{\phi-1}{\phi}}\right]^{\frac{\phi}{\phi-1}} \quad 20)$$

$$L_t^* = \left[\gamma (l_{T,t}^*)^{\frac{\phi-1}{\phi}} + (1-\gamma)(l_{N,t}^*)^{\frac{\phi-1}{\phi}}\right]^{\frac{\phi}{\phi-1}} \tag{21}$$

The sectorial demand of goods are given by

$$y_{T,t} = \frac{n\omega}{\gamma}\left(\frac{P_H}{P_T}\right)^{-\theta}\left(\frac{P_T}{P}\right)^{-\varphi} C + \frac{n^*\omega^*}{\gamma}\left(\frac{P_H}{P_T^*}\right)^{-\theta}\left(\frac{P_T^*}{P^*}\right)^{-\varphi} C^* \tag{22}$$

$$y_{T,t}^* = \frac{(1-n)\omega}{\gamma^*}\left(\frac{P_F}{P_T}\right)^{-\theta}\left(\frac{P_T}{P}\right)^{-\varphi} C + \frac{(1-n^*)\omega^*}{\gamma^*}\left(\frac{P_F}{P_T^*}\right)^{-\theta}\left(\frac{P_T^*}{P^*}\right)^{-\varphi} C^* \tag{23}$$

$$y_{N,t} = \frac{1-\omega}{1-\gamma}\left(\frac{P_{N,t}}{P_t}\right)^{-\varphi} C_t + G_t \tag{24}$$

$$y_{N,t}^* = \frac{1-\omega^*}{1-\gamma^*}\left(\frac{P_{N,t}^*}{P_t^*}\right)^{-\varphi} C_t^* + G_t^*. \tag{25}$$

while

$$l_{T,t} = f^{-1}\left(\frac{y_{T,t}}{A_{T,t}}\right), \tag{26}$$

$$l_{T,t}^* = f^{-1}\left(\frac{y_{T,t}^*}{A_{T,t}^*}\right) \tag{27}$$

$$l_{N,t} = f^{-1}\left(\frac{y_{N,t}}{A_{N,t}}\right), \tag{28}$$

$$l_{N,t}^* = f^{-1}\left(\frac{y_{N,t}^*}{A_{N,t}^*}\right) \tag{29}$$

Equations from (10) to (29) should be solved for the variables $\{\frac{P_t}{P_{T,t}}, \frac{P_{T,t}}{P_{H,t}}, L_t, C_t, l_{T,t}, \frac{P_t^*}{P_{T,t}^*}, \frac{P_{T,t}^*}{P_{F,t}}, L_t^*, C_t^*, l_{T,t}^*, \frac{P_t}{P_{N,t}}, \frac{P_t^*}{P_{N,t}^*}, l_{N,t}^*, l_{N,t}, T_t, T_{N,t}, T_{N,t}^*, \frac{P_{F,t}}{P_{T,t}}, \frac{P_{F,t}}{P_{T,t}^*}, y_{T,t}, y_{T,t}^*, y_{N,t}, y_{N,t}^*\}$ given the processes $\{\mu_{T,t}, \mu_{T,t}^*, \mu_{N,t}, \mu_{N,t}^*, A_{T,t}, A_{T,t}^*, A_{N,t}, A_{N,t}^*, G_t, G_t^*\}$.

We approximate the previous solution around a deterministic steady state in which the process $\{\mu_{T,t}, \mu_{T,t}^*, \mu_{N,t}, \mu_{N,t}^*, A_{T,t}, A_{T,t}^*, A_{N,t}, A_{N,t}^*, G_t, G_t^*\}$ are such that $\bar{\mu}_H = \bar{\mu}_H^* = \bar{\mu}_F = \bar{\mu}_F^* = \bar{\mu}_N = \bar{\mu}_N^* = \bar{\mu}$ and $A_T = A_T^* = A_N = A_N^* = A$, $G = G^* = 0$.[22] We assume for simplicity that $\gamma = \gamma^*$, $n = n^* = 1/2$, $\omega = \omega^* = \gamma$. We show that there is a steady-state in which $\frac{P_t}{P_{T,t}} = \frac{P_{T,t}}{P_{H,t}} = \frac{P_t^*}{P_{T,t}^*} = \frac{P_{T,t}^*}{P_{F,t}} = \frac{P_t}{P_{N,t}} = \frac{P_t^*}{P_{N,t}^*} = \frac{P_{F,t}}{P_{T,t}} = \frac{P_{F,t}}{P_{T,t}^*} = T_t = T_{N,t} = T_{N,t}^* = 1$, $L_t = l_{T,t} = l_{N,t} = \bar{L}$ and $L_t^* = l_{T,t}^* = l_{N,t}^* = \bar{L}^*$, $y_{T,t} = y_{T,t}^* = y_{N,t} = y_{N,t}^* = C_t = C_t^* = \bar{C}$. It is clear that equations (14-25) are satisfied by the above steady-state conditions. Moreover (26), (27), (28), (29) imply that

$$\bar{L} = f^{-1}\left(\frac{\bar{C}}{\bar{A}}\right) = \bar{L}^*, \tag{30}$$

while (10), (11), (12), (13) imply

$$1 = \bar{\mu}\frac{V_l(\bar{L})}{U_c(\bar{C})}\frac{1}{f'(\bar{L})\bar{A}}. \tag{31}$$

Equations (30) and (31) can be solved for $\bar{L}$ and $\bar{C}$ given $\bar{A}$. Under standard preference specifications the values $\bar{L}$ and $\bar{C}$ exist uniquely.

Maintaining the assumption that $\gamma = \gamma^*$, $n = n^* = 1/2$, $\omega = \omega^* = \gamma$ we study the solution of the model in a log-linear approximation of the structural equations for small perturbations of the exogenous shocks around the steady state outlined above. We start by log-linearizing equations (14) to (17). We obtain that

$$\widehat{\frac{P_{H,t}}{P_{T,t}}} = \widehat{\frac{P_{H,t}}{P_{T,t}^*}} = -\frac{1}{2}\hat{T}_t = -\widehat{\frac{P_{F,t}}{P_{T,t}^*}} = -\widehat{\frac{P_{F,t}}{P_{T,t}}}$$

$$\widehat{\frac{P_{N,t}}{P_t}} = \gamma\hat{T}_{N,t} = -\frac{\gamma}{1-\gamma}\widehat{\frac{P_{T,t}}{P_t}}$$

$$\widehat{\frac{P_{N,t}^*}{P_t^*}} = \gamma\hat{T}_{N,t}^* = -\frac{\gamma}{1-\gamma}\widehat{\frac{P_{T,t}^*}{P_t^*}}$$

22. In the numerical solution of sections 4 and 5 of the text, we instead assume a positive share of government consumption over output in the steady state.

Equation (19) yields to

$$-\rho(\hat{C}_t - \hat{C}_t^*) = (1-\gamma)(\hat{T}_{N,t} - \hat{T}_{N,t}^*). \tag{32}$$

A log-linear approximation to (10), (11), (12), (13) yields to

$$\hat{\mu}_{T,t} + (1-\gamma)\hat{T}_{N,t} + \frac{1}{2}\hat{T}_t + \eta\hat{L}_t + \rho\hat{C}_t - \frac{1}{\phi}(\hat{l}_{T,t} - \hat{L}_t) - \hat{A}_{T,t} + (1-\tilde{\lambda})\hat{l}_{T,t} = 0 \tag{33}$$

$$\hat{\mu}_{T,t}^* + (1-\gamma)\hat{T}_{N,t}^* - \frac{1}{2}\hat{T}_t^* + \eta\hat{L}_t^* + \rho\hat{C}_t^* - \frac{1}{\phi}(\hat{l}_{T,t}^* - \hat{L}_t^*) - \hat{A}_{T,t}^* + (1-\tilde{\lambda})\hat{l}_{T,t}^* = 0 \tag{34}$$

$$\hat{\mu}_{N,t} - \gamma\hat{T}_{N,t} + \eta\hat{L}_t + \rho\hat{C}_t - \frac{1}{\phi}(\hat{l}_{N,t} - \hat{L}_t) - \hat{A}_{N,t} + (1-\tilde{\lambda})\hat{l}_{N,t} = 0 \tag{35}$$

$$\hat{\mu}_{N,t}^* - \gamma\hat{T}_{N,t}^* + \eta\hat{L}_t^* + \rho\hat{C}_t^* - \frac{1}{\phi}(\hat{l}_{N,t}^* - \hat{L}_t^*) - \hat{A}_{N,t}^* + (1-\tilde{\lambda})\hat{l}_{N,t}^* = 0 \tag{36}$$

where $\eta \equiv \bar{V}_{ll}\bar{l}/\bar{V}_l$, $\rho \equiv -\bar{U}_{cc}\bar{C}/\bar{U}_c$, $(1-\tilde{\lambda}) \equiv -\bar{f}''\bar{l}/\bar{f}'$ with $\tilde{\lambda} \leq 1$. A log-linear approximation to equations (20) and (21) yields to

$$\hat{L}_t = \gamma\hat{l}_{T,t} + (1-\gamma)\hat{l}_{N,t}, \tag{37}$$

$$\hat{L}_t^* = \gamma\hat{l}_{T,t}^* + (1-\gamma)\hat{l}_{N,t}^*. \tag{38}$$

A log-linear approximation to equations (22), (23), (24), (25) yields

$$\hat{y}_{T,t} = \frac{\theta}{2}\hat{T}_t + \frac{\varphi}{2}(1-\gamma)\hat{T}_{N,t} + \frac{1}{2}\hat{C}_t + \frac{\varphi}{2}(1-\gamma)\hat{T}_{N,t}^* + \frac{1}{2}\hat{C}_t^*, \tag{39}$$

$$\hat{y}_{T,t}^* = -\frac{\theta}{2}\hat{T}_t + \frac{\varphi}{2}(1-\gamma)\hat{T}_{N,t} + \frac{1}{2}\hat{C}_t + \frac{\varphi}{2}(1-\gamma)\hat{T}_{N,t}^* + \frac{1}{2}\hat{C}_t^{*,} \tag{40}$$

$$\hat{y}_{N,t} = -\varphi\gamma\hat{T}_{N,t} + \hat{C}_t + \hat{G}_t, \tag{41}$$

$$\hat{y}_{N,t}^* = -\varphi\gamma\hat{T}_{N,t}^* + \hat{C}_t^* + \hat{G}_t^*, \tag{42}$$

where $\hat{G}_t = G_t/\bar{Y}$ and $\hat{G}_t^* = G_t^*/\bar{Y}$. Finally a log-linear approximation to (26), (27), (28), (29) imply

$$\lambda\hat{l}_{T,t} = \hat{y}_{T,t} - \hat{A}_{T,t} \tag{43}$$

$$\lambda\hat{l}_{T,t}^* = \hat{y}_{T,t}^* - \hat{A}_{T,t}^* \tag{44}$$

$$\lambda\hat{l}_{N,t} = \hat{y}_{N,t} - \hat{A}_{N,t} \tag{45}$$

$$\lambda\hat{l}_{N,t}^* = \hat{y}_{N,t}^* - \hat{A}_{N,t}^* \tag{46}$$

where $\lambda \equiv \bar{f}'\bar{l}/\bar{f}$. with $0 < \lambda \leq 1$.

We first solve the model for the aggregate variables and then we solve for relative prices and consumption. First, we take a weighted average of equations (33) and (35) with weights γ and $1-\gamma$ and obtain

$$\gamma\hat{\mu}_{T,t} + (1-\gamma)\hat{\mu}_{N,t} + \frac{\gamma}{2}\hat{T}_t + \left(\eta + 1 - \tilde{\lambda}\right)\hat{L}_t + \rho\hat{C}_t - \gamma\hat{A}_{T,t} - (1-\gamma)\hat{A}_{N,t} = 0$$

and take a weighted average of equations (34) and (36) to obtain

$$\gamma\hat{\mu}^*_{T,t} + (1-\gamma)\hat{\mu}^*_{N,t} - \frac{\gamma}{2}\hat{T}_t + \left(\eta + 1 - \tilde{\lambda}\right)\hat{L}^*_t + \rho\hat{C}^*_t - \gamma\hat{A}^*_{T,t} - (1-\gamma)\hat{A}^*_{N,t} = 0$$

We can define $\hat{\mu}_t \equiv \gamma\hat{\mu}_{T,t} + (1-\gamma)\hat{\mu}_{N,t}$, $\hat{\mu}^*_t \equiv \gamma\hat{\mu}^*_{T,t} + (1-\gamma)\hat{\mu}^*_{N,t}$, $\hat{A}_t \equiv \gamma\hat{A}_{T,t} + (1-\gamma)\hat{A}_{N,t}$, $\hat{A}^*_t \equiv \gamma\hat{A}^*_{T,t} + (1-\gamma)\hat{A}^*_{N,t}$ and take a weighted average of the above conditions with weights 1/2 and obtain

$$\hat{\mu}^W_t + \left(\eta + 1 - \tilde{\lambda}\right)\hat{L}^W_t + \rho\hat{C}^W_t - \hat{A}^W_t = 0, \tag{47}$$

where an index W denotes a weighted average of home and foreign variables. We can as well take a weighted average of (39) to (42), with weights $\frac{\gamma}{2}$, $\frac{\gamma}{2}$, $\frac{1-\gamma}{2}$, $\frac{1-\gamma}{2}$

$$\frac{\gamma}{2}\hat{y}_{T,t} + \frac{\gamma}{2}\hat{y}^*_{T,t} + \frac{(1-\gamma)}{2}\hat{y}^*_{N,t} + \frac{(1-\gamma)}{2}\hat{y}_{N,t} = \hat{C}^W_t + (1-\gamma)\hat{G}^W_t$$

We can use (43) to (46) to obtain

$$\hat{C}^W_t + (1-\gamma)\hat{G}^W_t = \lambda\hat{L}^W_t + \hat{A}^W_t. \tag{48}$$

We can use (47) and (48) to obtain

$$\hat{L}^W_t = \frac{1-\rho}{\lambda(\tilde{\eta}+\rho)}\hat{A}^W_t + \frac{\rho(1-\gamma)}{\lambda(\tilde{\eta}+\rho)}\hat{G}^W_t - \frac{1}{\lambda(\tilde{\eta}+\rho)}\hat{\mu}^W_t$$

and

$$\hat{C}^W_t = \frac{\tilde{\eta}+1}{(\tilde{\eta}+\rho)}\hat{A}^W_t - \frac{\tilde{\eta}(1-\gamma)}{(\tilde{\eta}+\rho)}\hat{G}^W_t - \frac{1}{(\tilde{\eta}+\rho)}\hat{\mu}^W_t$$

$$\hat{Y}^W_t = \frac{\tilde{\eta}+1}{(\tilde{\eta}+\rho)}\hat{A}^W_t + \frac{\rho(1-\gamma)}{(\tilde{\eta}+\rho)}\hat{G}^W_t - \frac{1}{(\tilde{\eta}+\rho)}\hat{\mu}^W_t$$

where we have de.ned $\tilde{\eta} \equiv (1 - \tilde{\lambda} + \eta)/\lambda$.. To solve for the difference variables in the model, we first consider equation (32) which can be written as

$$-\rho\hat{C}^R_t = (1-\gamma)\hat{T}^R_{N,t} \tag{49}$$

where a variable with a superscript R has been de.ned as the difference between the respective home and foreign variable.

We can take the difference between equations (33) and (34) to obtain

$$\hat{\mu}^R_{T,t} + (1-\gamma)\hat{T}^R_{N,t} + \hat{T}_t + c_1(1-\gamma)\hat{l}^R_{N,t} + \rho\hat{C}^R_t + (\gamma c_1 + c_2)\hat{l}^R_{T,t} - \hat{A}^R_{T,t} = 0$$

where we have defined $c_1 \equiv \left(\eta + \frac{1}{\phi}\right)$ and $c_2 \equiv (1-\tilde{\lambda}) - \frac{1}{\phi}$. Using (49) we can obtain

$$\hat{\mu}^R_{T,t} + \hat{T}_t + c_1(1-\gamma)\hat{l}^R_{N,t} + (\gamma c_1 + c_2)\hat{l}^R_{T,t} - \hat{A}^R_{T,t} = 0. \tag{50}$$

We can take the difference between (35) and (36) to obtain

$$\hat{\mu}^R_{N,t} - \gamma\hat{T}^R_{N,t} + \gamma c_1\hat{l}^R_{T,t} + \rho\hat{C}^R_t - \hat{A}^R_{N,t} + [(1-\gamma)c_1 + c_2]\hat{l}_{N,t} = 0,$$

which can be written as

$$\hat{\mu}^R_{N,t} - \hat{T}^R_{N,t} + \gamma c_1 \hat{l}^R_{T,t} - \hat{A}^R_{N,t} + [(1-\gamma)c_1 + c_2]\hat{l}_{N,t} = 0, \tag{51}$$

We can use equations (50) and (51) to solve for $\hat{l}^R_{T,t}$ to obtain

$$\lambda\tilde{\eta}c_3\hat{l}^R_{T,t} = -c_4\hat{\mu}^R_{T,t} - c_4\hat{T}_t + c_4\hat{A}^R_{T,t} + c_1(1-\gamma)\hat{\mu}^R_{N,t} - c_1(1-\gamma)\hat{T}^R_{N,t} - c_1(1-\gamma)\hat{A}^R_{N,t} \tag{52}$$

where $c_3 \equiv (1-\tilde{\lambda}) - \frac{1}{\phi}$ and $c_4 \equiv (1-\gamma)c_1 + c_2$.

We can also use (50) and (51) to solve for $\hat{l}^R_{N,t}$ to obtain

$$\lambda\tilde{\eta}\xi_\phi\hat{l}^R_{N,t} = \gamma c_1\hat{\mu}^R_{T,t} + \gamma c_1\hat{T}_t - \gamma c_1\hat{A}^R_{T,t} - c_5\hat{\mu}^R_{N,t} + c_5\hat{T}^R_{N,t} + c_5\hat{A}^R_{N,t} \tag{53}$$

where $c_5 \equiv \gamma c_1 + c_2$.

We can take the difference between (41) and (42), after using (45), (46) and 49 to obtain

$$\hat{l}^R_{N,t} = -c_6\hat{T}^R_{N,t} + \frac{1}{\lambda}\hat{G}^R_t - \frac{1}{\lambda}\hat{A}^R_{N,t} \tag{54}$$

where $c_6 = \varphi\gamma/\lambda + (1-\gamma)/(\rho\lambda)$. We can now take the difference between (39) and (40) and use the difference between (43) and (44) to obtain

$$\hat{l}^R_{T,t} = \frac{\theta}{\lambda}\hat{T}_t - \frac{1}{\lambda}\hat{A}^R_{T,t} \tag{55}$$

Equations (52), (53), (54), (55) can be solved for $\hat{l}^R_{N,t}$, $\hat{l}^R_{T,t}$, $\hat{T}^R_{N,t}$, $\hat{T}_t$. We can write the followingmatrix form in relation to the vector $x_t = [\hat{l}^R_{T,t} \;\; \hat{l}^R_{N,t} \;\; \hat{T}_t \;\; \hat{T}^R_{N,t}]$

$$Ax_t = Bs_t$$

where $s_t = [\hat{\mu}^R_{T,t} \;\; \hat{\mu}^R_{N,t} \;\; \hat{A}^R_{T,t} \;\; \hat{A}^R_{N,t} \;\; \hat{G}^R_t]$

$$A = \begin{bmatrix} \lambda\tilde{\eta}c_3 & 0 & c_4 & c_1(1-\gamma) \\ 0 & \lambda\tilde{\eta}c_3 & -\gamma c_1 & -c_5 \\ 1 & 0 & -\frac{\theta}{\lambda} & 0 \\ 0 & 1 & 0 & c_6 \end{bmatrix}$$

$$B = \begin{bmatrix} -c_4 & c_1(1-\gamma) & c_4 & -c_1(1-\gamma) & 0 \\ \gamma c_1 & -c_5 & -\gamma c_1 & c_5 & 0 \\ 0 & 0 & -\frac{1}{\lambda} & 0 & 0 \\ 0 & 0 & 0 & -\frac{1}{\lambda} & \frac{1}{\lambda} \end{bmatrix}$$

We can obtain the solution of the model for the flexible price allocations as

$$x_t = A^{-1}Bs_t.$$

7.1 Special case of linear production function reported in the text

In the linear case, i.e. $\lambda = 1$ and $\tilde{\lambda} = 1$, the relevant equations for the determination of $(\hat{T}_t, \hat{T}^R_{N,t}, \hat{L}^R_t, \hat{l}^R_{T,t}, \hat{l}^R_{N,t})$ reduced to

$$\begin{aligned}
\hat{\mu}^R_{T,t} + \hat{T}_t + \eta \hat{L}^R_t - \frac{1}{\phi}(\hat{l}^R_{T,t} - \hat{L}^R_t) - \hat{A}^R_{T,t} &= 0 \\
\hat{\mu}^R_{N,t} - \hat{T}^R_{N,t} + \eta \hat{L}^R_t - \frac{1}{\phi}(\hat{l}^R_{N,t} - \hat{L}^R_t) - \hat{A}^R_{N,t} &= 0
\end{aligned}$$

$$\begin{aligned}
\hat{l}^R_{N,t} &= -b\hat{T}^R_{N,t} + \hat{G}^R_t - \hat{A}^R_{N,t} \\
\hat{l}^R_{T,t} &= \theta \hat{T}_t - \hat{A}^R_{T,t} \\
\hat{L}^R_t &= \gamma \hat{l}^R_{T,t} + (1-\gamma)\hat{l}^R_{N,t}
\end{aligned}$$

where $b \equiv \varphi\gamma + (1-\gamma)\,\rho^{-1}$. Simple algebraic manipulation shows how to solve for $(\hat{T}^R_{N,t}, \hat{T}_t)$ and obtain equations (8) and (9) in the text.

Figure 1:
Dispersion in HICP -y-o-y growth rate

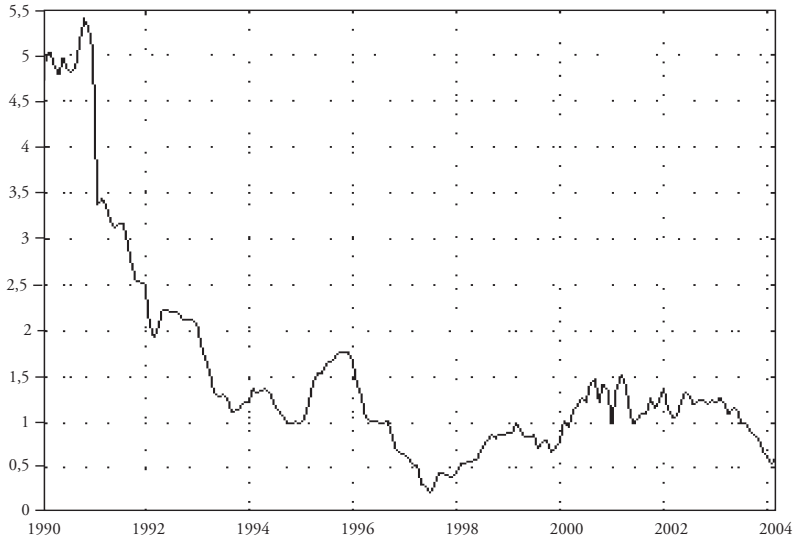
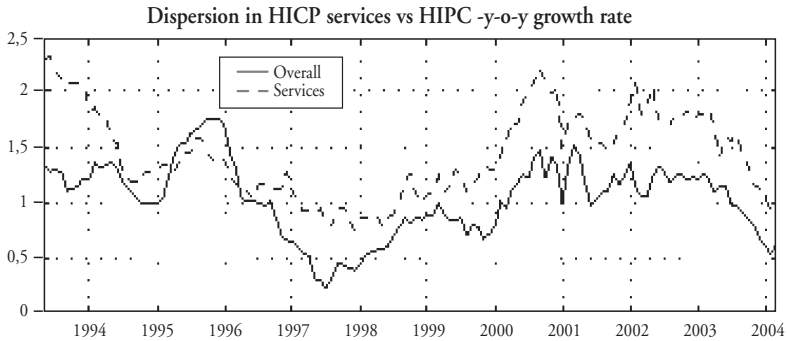


Figure 2-a:
Dispersion by sector



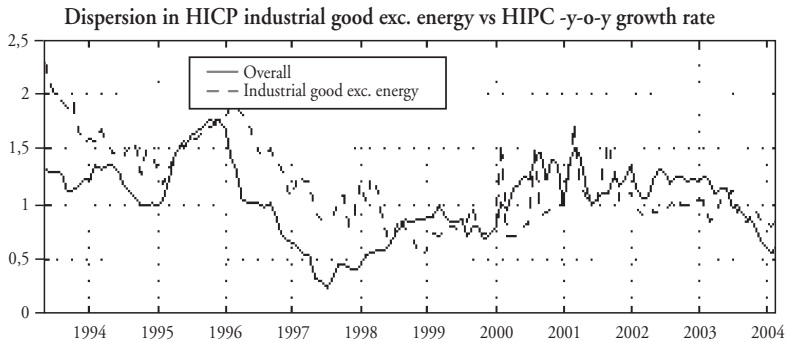
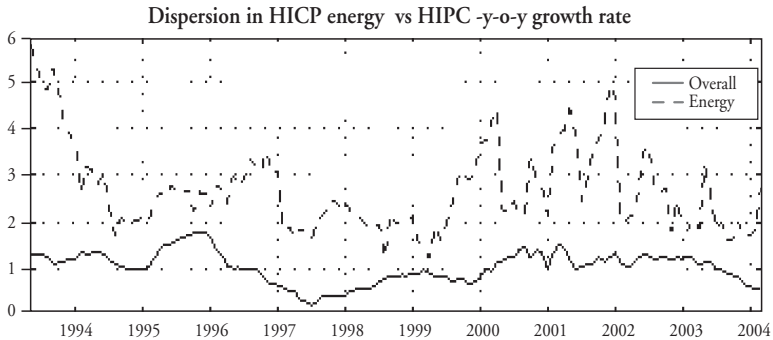


Figure 2-b:
Dispersion by sector



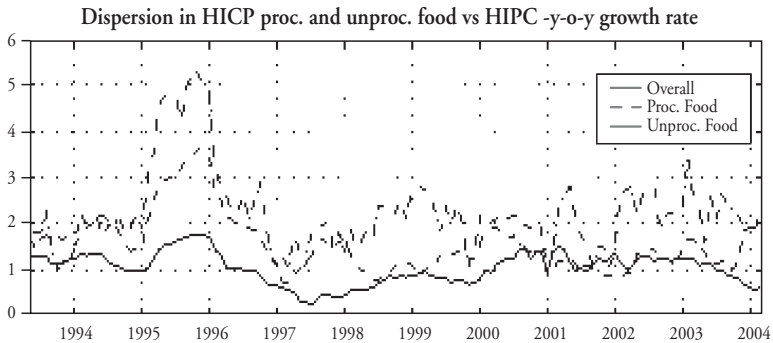


Figure 3:
Dispersion decomposition

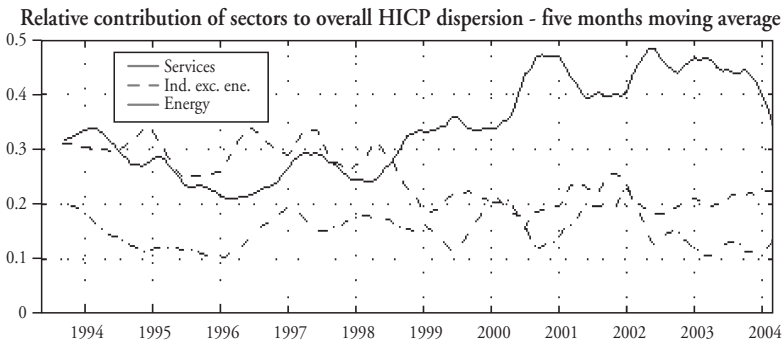


Figure 3:
Dispersion decomposition

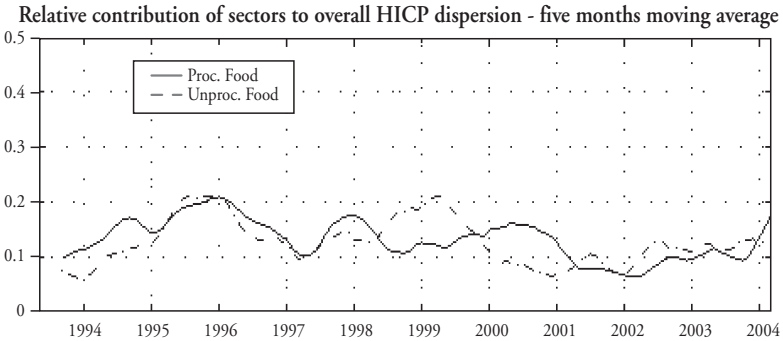


Figure 4:
Decomposition of Overall dispersion

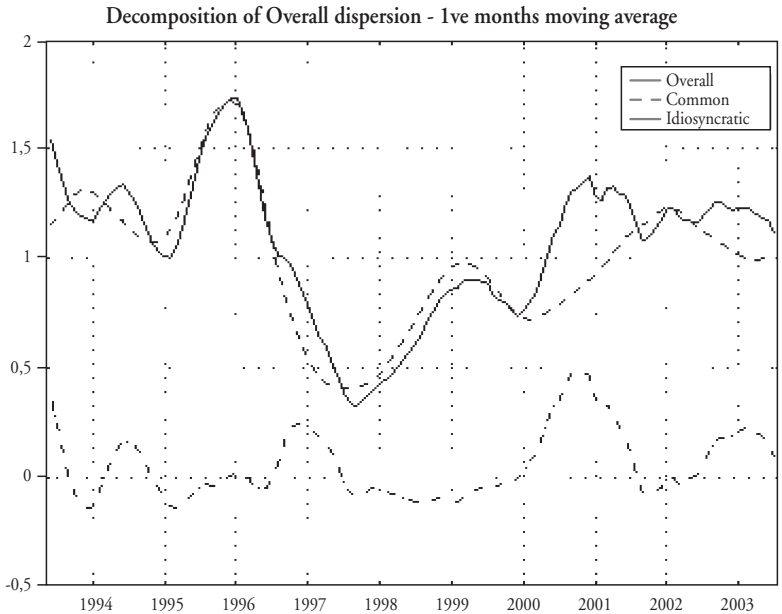


Figure 5:
Decomposition of Services dispersion

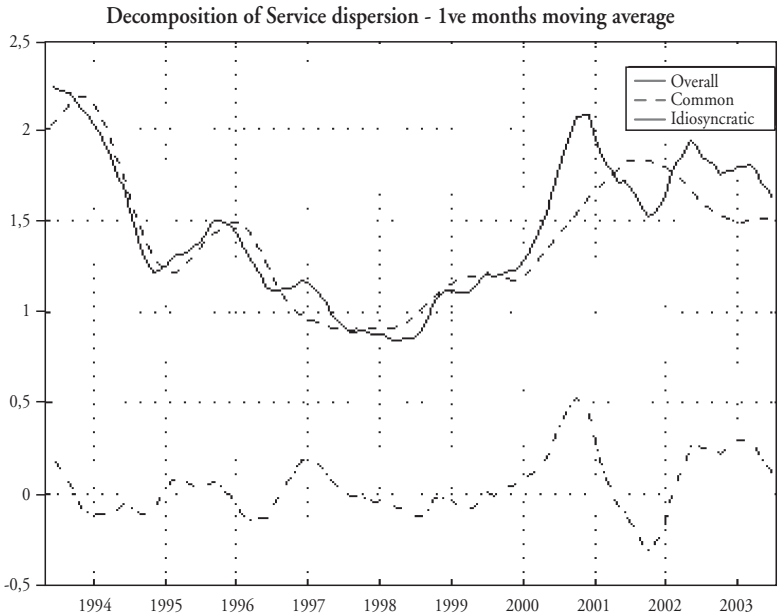


Figure 6:
Decomposition of Industrial Goods exc. energy dispersion

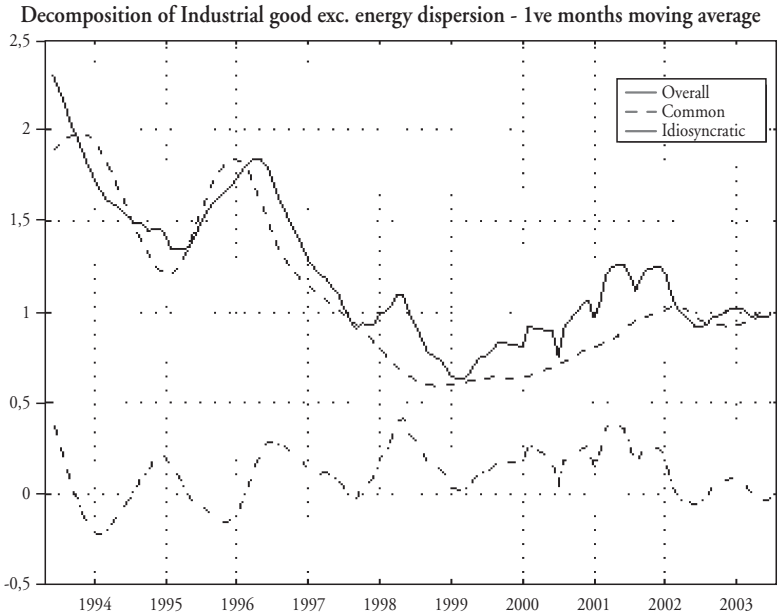
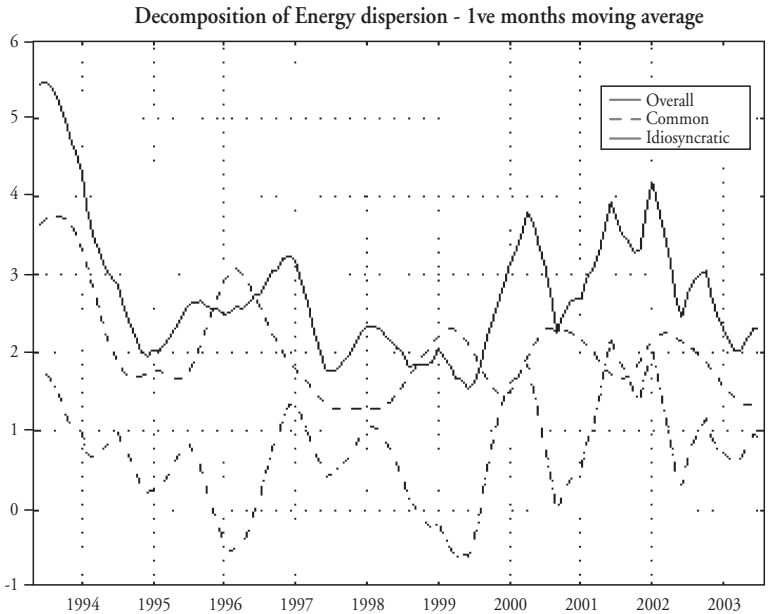


Figure 7:
Decomposition of Energy dispersion



Comments

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1 INTRODUCTION

The initial years of EMU have seen a fairly large dispersion in national inflation rates across the euro zone. From one perspective,this is quite ironic in that inflation rates had largely converged in the run-up to monetary union, only to diverge immediately there after. A reflexive initial response to the observed inflation differentials was to appeal to the Balassa-Samuelson effect: after all, national inflation rates were highest in the fastest-growing economies such as Ireland, Portugal and Spain and lowest in the sclerotic German economy. However, this monocausal explanation has by now largely been discounted in favour of a broader framework in which the observed inflation differentials are the outcome of heterogeneity in structures, policies and shocks across the eurozone. This contribution by Filippo Altissimo, Pierpaolo Benigno and Diego Rodriguez Palenzuela should be viewed as marking an important advance in our theoretical and quantitative understanding of how these dimensions interact to generate persistent differences in national inflation rates inside a monetary union[1]. In my remarks, I will briefly discuss the empirical evidence before turning to the theoretical model that is at the heart

1. Angeloni and Ehrmann (2004) is another interesting recent contribution.

of the paper. I will conclude by highlighting some potential directions for future research in this area.

2 Empirical Evidence

The authors do a nice job of marshalling the empirical evidence. Relative to other papers in this literature, the authors innovate by focusing on identifying the sectors most responsible for the divergence in aggregate inflation rates. Engel (1999) showed that real exchange rate fluctuations between countries with floating exchange rates were primarily driven by the relative price of tradables across countries that swamped any differentials in the evolution of the relative prices of nontradables. A plausible interpretation of this pattern is that is is generated by a combination of volatile nominal exchange rates plus sticky goods prices in each country. Since, by construction, there is no volatility in bilateral nominal exchange rates among members of a monetary union, this source of real exchange rate volatility is eliminated, which is one of the major efficiency gains from adopting a single currency. In this context, is not too surprising that the authors identify the services sector as primarily (although by no means exclusively) responsible for inflation differentials across the eurozone: with fixed nominal exchange rates, the role of the relative price of nontradables in determining real exchange rates moves naturally to the forefront.[2]

The second major contribution on the empirical front is to show that the observed inflation differentials arise not only from idiosyncratic country-specific shocks (although these are still important) but also from heterogeneous responses to area-wide common shocks. This makes intuitive sense in view of the obvious differences in the structural characteristics of the various eurozone member economies along many dimensions (country size; trade openness; the pattern of sectoral specialisation; wage-setting institutions; the extent of market regulation and barriers to entry; the scale of the public sector; demography). It also raises the important question of whether differential national policy responses to common shocks are in part responsible

2. At first glance, the significant divergence in inflation in the energy sector might seem surprising. However, the energy sector across the EU is undergoing significant market liberalisation and attendant restructuring. To the extent that this unleashes forces promoting cross-border price convergence, countries with initially-high energy prices will temporarily experience lower sectoral inflation.

for the observed heterogeneity in macroeconomic outcomes.

As such, the authors appropriately highlight important features of the eurozone experience that motivate the desirability of new and sophisticated theoretical modelling in this area.

3 THE THEORETICAL MODEL

The authors adapt the standard "new open economy macroeconomics" model in a number of interesting ways that are helpful in generating persistent inflation differentials within a monetary union.

An especially useful innovation is to allow for imperfect labour mobility across sectors and this is incorporated into the model in a tractable manner by assuming limited substitutability between different types of sector-specific labour. Allowing for this labour market friction generates wage differentials across sectors, which lines up with the interesting empirical evidence of Ortega (2003), and helps produce larger relative price movements in response to sectoral shocks. However, an accurate description of how the economy dynamically responds to a persistent shock should recognize that inter-sectoral labor mobility increases rapidly over time in response to persistent wage differentials, which could be captured by a "time to move" friction. Indeed, in a European context, the labour market adjustment has also involved significant cross-border migration flows: for instance, the services sector in Ireland now relies heavily on a elastic supply of workers from other parts of the European Union, plus the issuance of large volume of work permits to non-EU immigrants. (Honohan and Lane 2003 document a significant correlation between output gaps and migration flows across the eurozone.)

The authors also correctly incorporate market power in the tradables sector. As has been recently pointed out by a number of authors (with this literature well surveyed in the paper), a positive productivity gain in the tradables sector has two counteracting effects on the overall price level, with upward pressure on the relative price of non-tradables offset by a decline in the terms of trade. Which effect dominates depends on the relative values of the elasticities of substitution between home and foreign tradables and between tradables and non-tradables and the strength of nominal rigidities: the model is well set up to investigate the sensitivity of results to different choices about these structural parameters.

In addition to supply disturbances, the model can also handle various fiscal shocks and shocks to the level of sectoral competition (as expressed by the markup, which in turn depends on the elasticity of substitution across varieties). An additional type of wedge between costs and prices is also incorporated into the model with sector-specific ad valorem indirect taxes. With respect to the latter, an interesting extension could be to look at 'optimal' indirect tax rate: a live political issue in a number of eurozone countries has been whether price increases in various sectors should be offset by endogenous adjustment in the level of indirect taxation. The level of direct taxation on labour has also been discussed as a policy instrument: a rise in demand for local labour can in part be met by encouraging greater labour force participation and increased work effort through a reduction in labour taxes. I imagine that this feature could also be easily added to the model.

Along another dimension, the authors consider scenarios in which regions in the monetary union have different degrees of nominal price rigidity. This is an interesting feature. In particular, it is striking that it can generate sign reversals in the response of the real exchange rate to traded-sector productivity shocks relative to the outcome under flexible prices (see Figures 12 and 13). However, I have two concerns. First, an important extension is to allow for both wage and price rigidities. Second, an important challenge is to identify the underlying determinants of differences in nominal rigidities across member countries. In particular, are such differences attributable to structural characteristics (for instance, are some countries more heavily dependent on production sectors that have market structures that may generate the "real" rigidities that may underlie stickiness in nominal prices) or better explained by institutional features (for instance, the nature of the wage bargaining process, whether it is centralised or decentralised). If it is the latter, then it is possible that reform efforts can lead to an endogenous change in the degree of nominal stickiness, especially since there is an important social gain in achieving greater local price/wage flexibility with the elimination of the nominal devaluation option at the national level.

An interesting feature (that is perhaps too briefly discussed in the paper) is the inspection of how different monetary policy rules affect price dispersion. In particular, the authors highlight the impact of allowing the interest rate rule to target the output gap in addition to the inflation rate. While this is a useful first step, a challenge for futu-

re research is to identify the optimal monetary policy rule in this environment. In particular, does the optimal rule only target union-wide aggregate variables or is welfare enhanced by also taking into account regional differences (for instance, this could be the case if the degree of nominal rigidity indeed differes across regions, as shown by Benigno 2004). More generally, is there an interdependence between the optimal area-wide monetary policy rule and optimal fiscal rules at the national level? Working out the implications of such potential monetary-fiscal interactions is an exciting challenge for future extensions of this modelling approach.

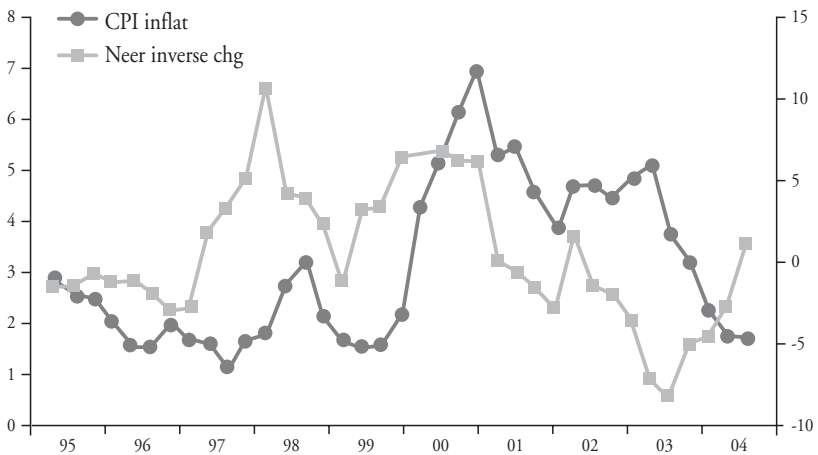
However, the model inevitably has a number of limitations. First, there is no investment in the model. I believe this misses an important source of differential inflation dynamics. For instance, it is well appreciated that persistent local inflation inside a monetary union generates procyclical real interest rates: with a common nominal interest rate, the high-inflation countries will have lower real interest rates than their low-inflation fellow members. This amplifies the local business cycle and generates local asset price booms, endogenously generating inflation persistence. Of course, a positive inflation differential cumulates into real appreciation, which over time should offset this effect.

Second, although analytically convenient, the assumption of perfect international risk-sharing also closes down another source of inflation divergence. A core prediction of the model is that consumption growth should be slower in the region experiencing real appreciation: the risk-sharing arrangement should be efficiently transferring resources to households in the region where the price of consumption is more attractive. I suspect that the data would show the opposite pattern, with the high-inflation country also experiencing faster consumption growth. (This would also be consistent with the procyclical local real interest rate mechanism outlined in the previous paragraph.)

Third, the authors treat the monetary union as being closed with respect to the rest of the world. This is a serious disadvantage in understanding the sources of inflation differentials inside the eurozone. Honohan and Lane (2003, 2004) have highlighted that there is substantial heterogeneity among eurozone members in terms of their trade linkages with non-EMU partner countries and shown that movements in national trade-weighted multilateral exchange rates are significantly correlated with local inflation rates. Most famously,

movements in the external value of the euro (especially vis-a-vis the dollar and sterling) are a good predictor of Irish inflation, in view of Ireland's extremely strong trade linkages with these non-EMU countries (see also Figure 1). Fitzgerald (2003) has made a similar point at a conceptual level: in explaining the bilateral real exchange rate between any pair of countries, it is vital to keep track of heterogeneity in their respective linkages with all other trading partners.

Figure 1:
12-month moving average of percent change (plotted quarterly) in CPI (left hand scale) and in nominal effective exganhe rate index (rigth hand scale).



Source: Honohan and Lane (2004).

4 CONCLUSIONS

In summary, this is an excellent paper which provides a useful theoretical environment for analysing the source of heterogeneous macroeconomic performance across members of a currency union. Its well specified microeconomic foundations also means that it should be an adaptable framework that can be extended to include other potentially important features, such as the roles of international price discrimination in the tradables sector and the importance of nontraded distribution services in determining the consumer prices of tradables (see, for instance, Andres et al 2003, Corsetti and Dedola 2004). Another potentially interesting route is to allow for firm-level and industry-level heterogeneity in productivity and trade costs that

can generate further sources of persistence and price dispersion through the endogenous entry of firms and shifts in the nontraded/traded margin (Bergin and Glick 2004, Ghironi and Melitz 2004).

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Comments

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This paper by Filippo Altissimo, Pierpaolo Benigno and Diego Rodriguez Palenzuela is a nice contribution to the research on the country/sectoral differentials in the inflation measures in the Euro area. Inflation differentials can be an important policy issue for the conduct of monetary policy by the European Central Bank. Inflation differentials may represent the fact that business cycles in the member countries are not perfectly synchronised. The inflation differentials may represent certain ineficient fluctuations in the relative prices of goods in different sectors or in different countries. Or they may represent eficient fluctuations in the relative prices.Furthermore, it is not obvious whether and how the ECB should respond to the observed inflation differentials. In the light of this, I think the following issues are important for the analysis of inflation differentials.

1. How large are the inflation dispersions?
2. Which sector contributes to inflation differentials? For example, is it traded good sector or non-traded goods sector? Is it manufacturing sector or services sector?
3. What causes inflation differentials? Are they caused by idiosyncratic (countryspecific or sector-specific) shocks or caused by the heterogenous responses of each country to common shocks?

4. Are the observed inflation differentials eficient or ineficient from the welfare point of view?
5. Should the ECB stabilise inflation differentials? What is the eficient level of inflation differentials?
6. If so, how should the ECB respond to the inflation differentials?

The first three questions are concerned with the positive analysis of inflation differentials, and the remaining three questions are concerned with the normative analysis. The authors of the paper mainly focus on the positive analysis of inflation differentials. More specifically, they use a dynamic factor model and a dynamic stochastic general equilibrium model model to analyse inflation differentials in the long run. What I mean by 'long-run' is the situations in which nominal rigidities disappear so that flexible prices are a good approximation. The paper offers many interesting findings that are useful for us to think about inflation differentials.In this comment, I would like to discuss the relationship between their empirical model and theoretical model, and some welfare issues.

SOURCES OF INFLATION DIFFERENTIALS

The authors found that the inflation differentials in the Euro area are large, and most of the inflation differentials is driven by the services and energies sectors, which are the proxy for non-traded goods. The contribution of industrial-goods sector is found to be small. These are their answers to questions 1 and 2.

In order to answer to question 3, the authors use two methods. Firstly, they estimate a dynamic factor model to see how much of the inflation differentials is explained by common factors and idiosyncratic factors. Their analysis shows that common factors are responsible for the large part of the observed inflation differentials. That means that the inflation differentials are mainly caused by heterogenous responses of each country to 'common shocks'.

However, the dynamic factor analysis does not tell us which kind of structural shocks represent the common factors.Is it demand shock, or supply shock, or policy shock? Do the common shocks identified by the dynamic factor analysis represent some Euro-wide shocks such as monetary policy shocks, or country-specific shocks of

the large countries such as Germany and France that can affect the rest of the member countries? The theoretical model in this paper attempts to answer to those questions.

The authors construct a two-country model of a currency area with equal population size. Each country has a traded-goods sector and a non-traded goods sector, and the law of one price holds in the traded-goods sector. Therefore, the inflation differentials in the model are generated by the non-traded goods sectors in the two countries, which is consistent with their empirical findings. The authors focus their analysis on the case in which prices are fully flexible. Although this assumption prevents them from assessing the contributions of monetary policy and nominal rigidities to the inflation differentials, it allows them to obtain some nice and useful analytical results that help us to understand the mechanics of the inflation differentials. Among other results, one of the most interesting analytical results is the condition under which the Balassa-Samuelson effects are relevant. The authors also compute the variance decomposition of the inflation differentials, and found that the technology shock in the non-traded goods sector is the main source of inflation differentials.

While their theoretical exercise is informative about the sources of inflation differentials, it does not give us a clear answer to the question of what the common factors in their dynamic factor analysis represent. It is not still clear whether the common factors represent a country specific shock of a large country that affects the entire Euro area, or they represent asymmetric responses of a Euro-wide shock.One possible way to answer to this question would be to conducts stochastic simulation using the model, and to apply the dynamic factor analysis to the model-generated data. Then, one can compare the factors identified from the true data with those identified from the model-generated data.That could be a measure of how successfully their model can replicate the stylised facts.

Does inflation differentials matter for welfare?

The paper focuses on the positive analysis of the inflation differentials in the long run. The remaining questions regarding the inflation differentials are the short-run analysis and the welfare analysis. I believe those are very interesting and important questions, and I expect that further research will be done in the near future.

In the short-run, nominal rigidities may playan interesting role in the determination of the inflation differentials. Heterogeneity in nominal rigidities across sectors and countries can generate different responses of each sector/country to common real and nominal shocks.

From the welfare point of view, the first question is: 'should we care the inflation differentials' ? Do the inflation differentials generate welfare loss, and should the ECB seek to stabilise the inflation differentials? In order to answer to those questions, one could set up an optimal policy problem for the currency area, and can derive the optimal responses of inflation differentials in response to economic shocks. This exercise would be able to identify 'effcient inflation differentials.'

Then one can examine whether or not the actual inflation differentials observed in the data are eficient.In addition to this, one can derive the optimal monetary policy response to inflation differentials. The question here is whether the Bank should react directly to the inflation differentials. Is HICP targeting a good approximation of the optimal policy, or does the welfare improve significantly if the ECB includes some measures of inflation differentials in its targeting criterion? A useful benchmark would be Benigno (2004). Benigno (2004) considers a simpler model of a currency area than the current paper considers. It is shown that HICP targeting can be a good approximation to the optimal policy. It would be interesting to see how the results would change under the richer model the authors consider in this paper.

Those exercise require a full welfare analysis. Since the authors have been actively contributing to the literature on optimal monetary policy, I expect that they will extend the current paper to address those welfare questions about inflation differentials.

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Discussion

Stephen Cecchetti argues that the measure of inflation dispersion should use some weigthing proportional to the size of the country. Stephen also points out that in this paper inflation dispersion is the resul of different responses to a common shock, and therefore the authors have to make a strong argument to respond to the commons shock separately.

Javier Vallés points out that a two-country, two-sector model with flexible prices cannot reproduce inflation differentials. He says that besides differences in the steady state due perhaps to differences in size, openness, etc, there could be frictions or other explanations, and this is relevant for efficiency and to determine if there is a role for monetary policy.

Fernando Ballabriga remarks the contrast between the result that common factors are the main source of price dispersion and the paper yesterday where idiosyncratic factors were the determinat of price dispersion.

David López-Salido argues that while in the model inflation differentials have to do with the prices of non-tradable goods, we know that there are substantial differences in the price of tradable goods. David also claims that the assumption of complete markets is a very strong one. Finally, David argues that according to the model the policy prescription would be to target just the inflation of the non-tradable goods, what amounts to target the inflation of the stickier country, and forget about the tradable goods inflation.

Diego Rodríguez Palenzuela thanks all fot the comments. He recognizes that having a steady state with asymmetries is crucial. He also agrees that the assumption of complete markets is very important and says that they are working on this issue, but cannot report anything yet. Diego says that he deliberately did not mentioned much of the common factor analysis, because it could create confusion with respect to the theoretical part of the model. Finally, Diego points out that the descriptive results do use weigthing.

Political Decision Making in the Enlarged EU

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Mika Widgren
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"Under current practices, members are accorded votes in relation to their populations; small countries have disproportionate number of votes. Since … most of the CEECs are small (eight of the CEEC-10 have 10 million or less, five of them with 5 million or less), the CEECs would have an important number of votes. This would have momentous implications for politics in the Union. … EU voting procedures must be overhauled before any substantial enlargement occurs." (Baldwin 1994 p. 180).

1. Introduction

It has long been known that Eastern enlargement would require reform of the EU's decision making rules. Rules that were designed for 6 and were creaking with 15 members would simply collapse under the weight of 25 members. Recognising this, the voting reform issue was supposed to have been tackled in IGC 1996 and the Amsterdam Treaty. Since the most likely revisions would have greatly changed the power distribution among EU members and enlargement was viewed as a distant problem, leaders postponed the issue by creating the "Amsterdam Leftovers", one of which was reform of Council voting rules.

These leftovers should have been dealt with in the IGC 2000 and Nice Treaty, but political leaders again failed. The Nice Treaty did adopt a radical reform, but the reform was decided late at night with little or no preparation. Not surprisingly, the result was a failure – the Nice Treaty rules actually made decision making even harder in the enlarged EU than it would have been with no change at all. Realising their mistake, they knew they would have to reform the reformed voting rules even before they came into effect. The most obvious route would have been to revise the Nice Treaty, but this would have required them to admit their mistake. Instead, EU leaders took a new

tack. Reform of voting reform rules thus became the driving political force behind European Convention and the Constitutional Treaty.

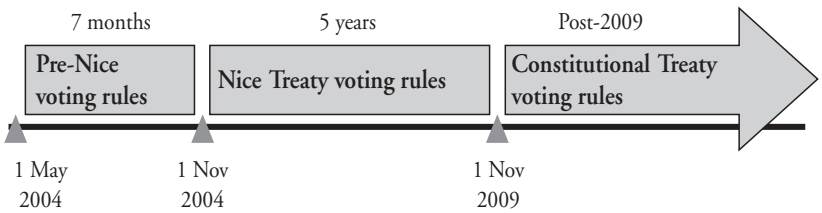
Despite the importance of voting rules, the issue was not opening discussed at the Convention. Giscard d'Estaing and a narrow circle of advisors devised a scheme on their own, dropped it into the draft at the last minute and managed to suppress any real debate on the issue. Giscard's rules had been roundly rejected in the two previous IGCs, so it was not a surprise when the EU heads of state decided to discard Giscard's rule at their December 2003 Summit. The issue was finally settled under enormous pressure, after the enlargement occurred, namely at the June 2004 EU Summit. The solution was inserted into the Constitutional Treaty. The ultimate fate of this ad hoc process is still unknown since the Constitutional Treaty must be ratified by all 25 members – a process that could easily fail. Among the many problems involved, the 10 newcomers approved membership under the Nice Treaty voting rules. As we show in this paper, the Constitutional Treaty rules substantially reduce the power of all but a few of the smallest members. Thus euroskeptics the newcomer nations may be able to portray the Constitutional Treaty as a bait-and-switch tactic (get them in and then reduce their power). Worse still, even if everything goes right with the Constitutional Treaty's ratification, the flawed Nice-Treaty rules will be in place for the first 5 years of the enlarged EU existence (up to November 2009).

This paper presents an analysis of the decision making rules that will govern the EU's main decision making body, the Council of Ministers, for the coming years.The next section presents the details for the various voting reforms, before Section 3 analyses the power implications. Section 4 studies the reforms from an decision-making capacity perspective and the final section presents our concluding remarks.

2. COUNCIL OF MINISTER VOTING REFORM

The Constitutional Treaty proposes a radical change in Council's voting procedure, but in fact three sets of voting rules that will govern the Council of Ministers' decision making for the years to come, even if the Constitutional Treaty comes into force. Figure 1 illustrates the timing.

Figure 1.
Timeline for the various voting rules agreed at June 2004 Summit



The Constitutional Treaty explicitly sets out two sets of Council's voting procedure and implicitly recognizes the current system set up by the Accession Treaty (Article 24). To set the stage for our analysis, we provide a brief description of the three sets of voting rules.

Status quo

The Council of Ministers (or the Council for short) has two main decision-making rules. On the most important issues, like Treaty changes, the accession of new members, and setting the multi-year budget plan, Council decisions are by unanimity. On most issues (about 80% of all Council decisions), the Council decides on the basis of what is known as "qualified majority voting", or QMV for short.

The basic form of the QMV procedure has been unchanged from its origin in the 1958 Treaty of Rome. Each member's minister casting a certain number of votes with more populous members having more votes, but many fewer than population-proportionality would suggest.

For example, France with its 60 million citizens has 10 votes while Denmark with its 5 million citizens has 3; the total number of votes in the EU15 is 87. The threshold for a winning majority, what is called a "qualified majority," is 62 votes. This means that a majority of about 71% of all votes is required to adopt a proposal.

The implications of this system are complex. Since bigger members have more votes, 71% of the votes does not mean 71% of members. Three large members voting 'no' could block adoption even if the other 12 voted 'yes'. And since small nations get far more votes

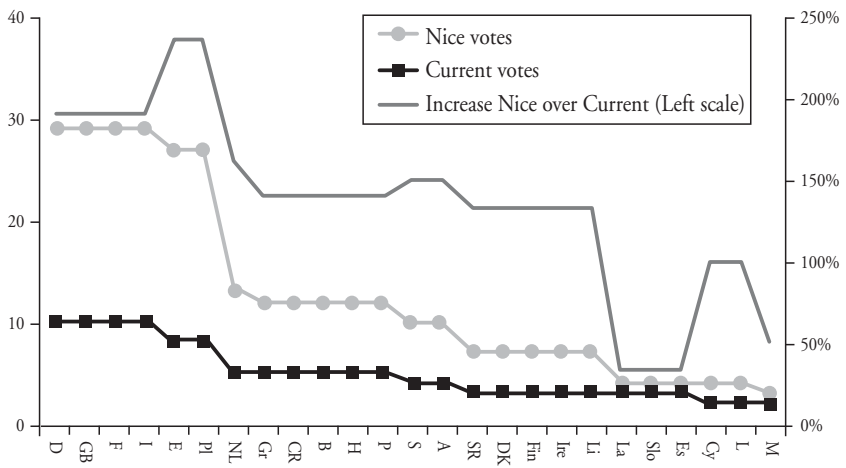
than strict population-proportionality would suggest, 71% of the votes does not mean 71% of the EU population. The 71% threshold can theoretically be reached, for example, by a coalition of just 8 members representing 58% of the EU population.

Up to November 2004, the pre-Treaty of Nice rules apply, namely qualified majority voting. with weighted votes and the old majority threshold of 71% to win. The numbers of votes for the incumbent 15 are unchanged; those for the 10 newcomers are a simple interpolation of EU15 votes as specified in the Accession Treaty. From November 2004 to October 2009 the Nice Treaty rules apply (as per the "Draft Council Decision relating to the implementation of Article I-24").

Nice Treaty rules

The Nice rules maintain the basic 'qualified majority voting' framework, but add two extra criteria concerning the number of yes-voters and the population they represent. Specifically, the vote threshold is 72.2% of the Council votes (232 of the 321 votes), the member threshold is 50% of members (13 members), and the population

Figure 2.
Treaty of Nice and Accession Treaty reweighing of Council votes



Notes: D=Germany, GB=Great Britain, F=France, I=Italy, E=Spain, Pl=Poland, NL=Netherlands, Gr=Greece, CR=Czech Republic, B=Belgium, H=Hungary, P=Portugal, S=Sweden, A=Austria, SR= Slovak Republic, DK=Danemark, Fin= Finland, Ire=Ireland, Li=Lithuania, La=Latvia, Slo=Slovenia, Es=Estonia, Cy=Cyprus, L=Luxembourg, M=Malta

threshold is 62% of the EU population[1]. Additionally, the Nice rules redistributed votes in a way that heavily favoured the big and near-big members, as Figure 2 shows; Spain and Poland won disproportionate increases. We call this the "Aznar Bonus".

Constitutional Treaty rules

From November 2009 the CT double majority rules will apply (assume the CT enters into force). A winning coalition must represent at least 55% EU members and 65% of the EU population. A last-minute Summit compromise inserted the requirement at least 15 members vote 'yes', but this is irrelevant; 15 members of 25 is 60% and thus greater than 55%, but by the time these rules take effect, the EU should have 27 members and 55% of 27 is 15 binding changes are in the Accession Treaty. Since EU leaders eventually realised how inefficient the Nice rules were, they improved efficiency by lowering the vote threshold from the 74% mentioned in the Nice Treaty.

(Bulgaria and Romania are pencilled in for membership in 2007). The 15 member rule will be redundant when it takes effect.

3. ANALISYS OF POWER IMPLICATIONS

Measuring the power implications of a voting rule is difficult. In this section we discuss various measures of power and present our results on how the CT altered the power distribution in the enlarged EU. Before turning to our results, we briefly explain why the most intuitive measure of power – a nation's vote share, is generally not useful.

3.1. Vote shares as a power measure

To illustrate the potential pitfalls of vote weights as a power measure, consider a "toy model" of the Council. Suppose there are only

1. The rules that take effect in November 2004 are not those agreed at the Nice Summit, December 2000. The deal struck at 4 a.m. at the end of the longest EU Summit in history was a political commitment. The legally the binding changes are in the Accession Treaty. Since EU leaders eventually realised how inefficient the Nice rules were, they improved efficiency by lowering the vote threshold from the 74% mentioned in the Nice Treaty.

three countries in this toy model – imaginatively called A, B and C – and they have 40, 40, and 20 votes respectively. Decisions are made based on a simple majority rule (50%+ to win). If we used voting weights as a measure of power, we would say that countries A and B with their 40 votes were twice as powerful as C with its 20 votes. This is wrong. With a bit of reflection you can convince yourself that all three nations are equally powerful in this toy Council. The point is that any winning coalition requires two nations, but any two nations will do. Likewise, any pair of nations can block anything. As a consequence, all three nations are equally powerful in the sense that they are equally likely to make or break a winning coalition.

The level of the majority threshold can also be important for power. For example, continuing with our toy model, raising the majority rule from 50% to 75% would strip nation C of all power. The only winning coalition that C would belong to is the grand coalition A&B&C but here C would not be able to turn it into a losing one by leaving the coalition. Therefore C's vote can have no influence on the outcome. Again, vote shares in this example would give a very incorrect view of power. More generally, power – i.e. the ability to make or break a winning coalition – depends upon a complex interaction of the majority threshold and exact distribution of votes.

Lastly, the vote share measure is conceptually difficult to apply to dual majority systems since the vote share is not well defined.

3.2. NBI as a power measure

In reaction to counter examples such as the one above, a number of more sophisticated measures have been developed. Admittedly, these fail to capture the full richness of the political interactions that can heavily influence EU power, but at least they provide a clear point of departure for more political evaluations. The specific numerical measure of power presented here is the one Mika Widgren and I have been using to evaluation the various proposals since 1999, namely that normalised Banzhaf index[2]. The intuitive motivation of the NBI is simple, even if its actual calculation is complex. A computer looks at how likely it is that each member's vote is crucial on a randomly drawn issue – crucial in the sense that its vote can make or break a

2. The particular measure is the "normalised Banzhaf index" (NBI) invented by Penrose (1946) but named after its re-inventor, Banzhaf (1965).

winning coalition. The NBI is each members share of all the times any member is crucial. The basic idea is that members who are frequently crucial to a vote may ask for special favours, thus influencing EU policies.

More formally, working out the NBI requires a computer to look at all coalitions (i.e. all conceivable line-ups of yes and no votes) and identify the winning coalitions. Note that the number coalitions for a group of 'n' voters is 2^n, so in the EU15, 32,768 coalitions have to be checked. In the EU27, the number is over 134 million. The computer then works out all the ways that each winning coalition could be turned into a losing coalition by the defection of a single nation. Finally, the computer calculates the number of times each nation could be a "deal breaker" as a fraction of the number of times that any country could be a deal-break. The notion is that the Council decides on a vast array of issues, so the NBI tells us how likely it is that a particular nation will be critical on a randomly selected issue.

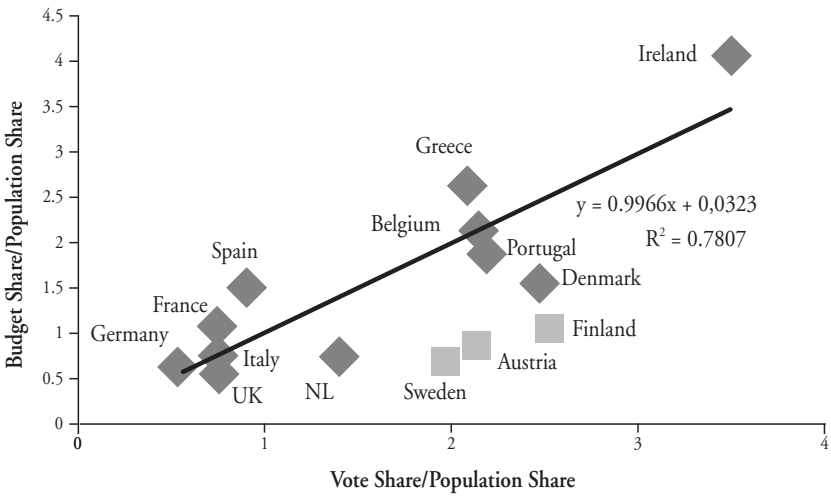
Does the NBI have anything to do with the power of EU members in the real world? One cannot measure a nation's power in EU decision making directly, but the exercise of power does leave some "footprints" in the data. Budget allocations are one manifestation of power that is both observable and quantifiable. To check whether our power measure is useful we see if it can help explain the historical budget allocation in the EU.

3.2.1 Evidence on NBI's relevance

To understand why the NBI measure should be related to outward signs of power like the budgetary spending allocation, we need to briefly review the logic of pork barrel politics. Citizens in EU nations, or at least some citizens, benefit when EU money is spent in their district. Successful politicians, responding to the desires of their citizens, use their political clout to direct money homewards. For example, suppose that countries ask for a little "gift" each time they find themselves in a position that is critical to a winning coalition. In the data, the "gift" ends up as EU spending, but the actual mechanism could be subtle, say a more favourable treatment in the allocation of EU subsidies to hill-side farmers, a more generous allocation of milk quotas, or inclusion of reindeer meat in the CAP's price support mechanism. In this light, it seems natural that a country's power measure would equal its expected fraction of all special gifts handed out. If one goes to the cynical extreme and views the whole EU budget as

nothing more than a pile of 'gifts', then our power measures should meet the EU's budget allocation perfectly. If high-minded principles such as helping out disadvantaged regions also matter, then the power measure should only partially explain the spending pattern.

Figure 1.
EU15 per capita vote shares and budget share (average 1995-2000)



Source: Adapted from Baldwin (1994) Figure 7.2 using European Commission total allocated expenditure data (average over 1995 to 2000 to smooth out annual fluctuations). Luxembourg is an outlier: Luxembourgers have 20 times more votes per person than the EU15 average and they get.

Council vote shares go a long way towards solving the "puzzle" of EU budget allocation discussed in Chapter 2. The horizontal axis in the top panel of Figure 1 plots a measure of the 'bias' in each nation's power per person; specifically, it plots the ratio of each nation's share of Council votes to its share of EU15 population. To understand why this reflects the power bias, suppose a nation has a ratio of exactly 1.0. This would imply that the Council votes per citizen in that nation are exactly equal to the EU15 average. For example, Spain's vote share to population share ratio is 0.9. This means that Spaniards have slightly less than the average number of votes. Greece, on the other hand, has a ratio of 2.6 which means Greeks have 2.6 times more votes per person than the EU average.

The vertical axis plots a measure of the bias in each nation's receipt per capita. Again, to put everything on a common scale, the precise measure we use is the ratio between the nation's share of EU spending and its share of the EU's population. As with the per capita power

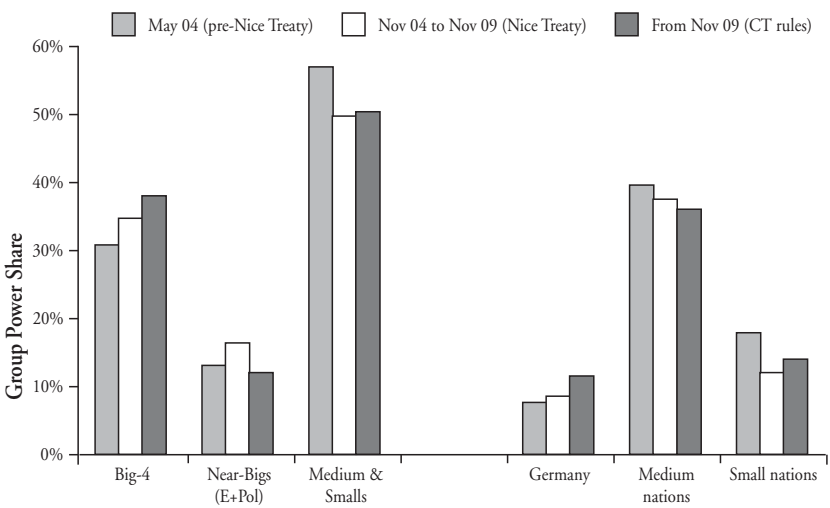
measure on the horizontal axis, 1.0 on the vertical axis implies the average receipts per person taking the EU15 as a whole. Plainly, there is a distinct positive relationship between power-per-person and receipts-per-person. We take this as rough evidence that the NBI does capture power in a meaningful way.

3.3. Power shifts due to the 2 rule changes

As noted above, the Constitutional Treaty (CT) implies two rule changes: the status quo to Nice, and Nice to CT rules. The Nice Treaty rules will shift a great deal of power from Small and Medium-sized members to the Big and Near-Big members (see Figure 2 for group definitions). While it was agreed in 2000, this power-shift comes into effect only in November 2004. Spain and Poland as a group see their power rise by about 3.5 percentages – this is the power implication of the Aznar vote bonus. The Big-4's slice expands by about the same. The wider slices of the Bigs and Near-Bigs come from the slices of the Mediums and Smalls.

The Constitutional Treaty agreed at the June 2004 Summit shifts even more power to the Big4, but this time, the Near-Bigs pay for the

Figure 2.
Winners and losers, big vs medium and small members



Notes: Big-4 = Germany, Britain, France, Italy; Medium nations (25 to 5 million, Romania, Netherlands, Greece, Czech Rep., Belgium, Portugal, Hungary, Sweden, Bulgaria, Austria, Slovak Rep., Denmark.

Big-4's gain (the Big-4's gain almost exactly matches the Spanish and Polish loss). We call this drop in Spanish and Polish power the "Zapatero compromise". When the Zapatero-compromise comes into effect in November 2009, it will more than completely reverse the Aznar-bonus, leaving these two Near-Big nations with a small drop in their combined power share. Small and Medium-sized nations see little change in aggregate, but power shifts moderately from the Mediums to the Smalls.

In short, the two-step voting-rule changes greatly boost the power of the EU's 4 largest members (Germany, Britain, France and Italy). The Big-4's power gain from the Nice rules comes at the expense of small and medium-sized members. Their additional power gain from the CT rules comes at the expense of Spain and Poland.

3.4. Results by nation

The CT will have to be ratified by each nation so the power implications per nation may be important in national debates. The top panel of Figure 3 shows that each of the Big and Near-Big members will see their power boosted substantially at the end of this year. By contrast, all the Mediums and Smalls lose with the cuts being particularly marked for the Latvia, Slovenia and Estonia. The extra-large losses to these three nations are due to their low allocation of votes under the Nice rules. The Nice Treaty allocated votes 'by hand' and these three nations – with 1 to 2 million people – were not at the table to argue their case. Without a natural benchmark-member at the table to fight for votes, these three fall-between nations got short-changed in the vote allocation undertaken by EU15 leaders.

The gains of Spain and Poland from the Nice rules are striking. With the Nice reforms, Spain and Poland are set to become almost as power as Germany, even though they have only half Germany's population. To be specific, their NBIs are 7.4% while that of Germany is 7.8%; for comparison, the Netherlands's is 4% (see Table 1). Given this, the Spanish and Polish reluctance to accept the CT rules is easily understandable.

The bottom panel of Figure 3 shows that the CT rules will shift even more power to Germany while taking a great deal of power away from Spain and Poland. In short, the "Aznar bonus" (Spain gained almost twice as much as France in the Nice-Treaty negotiations) will

Table 1:
Power shares under the Nice system, EU27

	Nice Rules	No Reform		Nice Rules	No Reform
Germany	7.8%	7.0%	Bulgaria	3.1%	3.1%
UK	7.8%	7.0%	Austria	3.1%	3.1%
France	7.8%	7.0%	Slovakia	2.2%	2.4%
Italy	7.8%	7.0%	Denmark	2.2%	2.4%
Spain	7.4%	5.9%	Finland	2.2%	2.4%
Poland	7.4%	5.9%	Ireland	2.2%	2.4%
Romania	4.3%	4.6%	Lithuania	2.2%	2.4%
Netherlands	4.0%	3.8%	Latvia	1.3%	2.4%
Greece	3.7%	3.8%	Slovenia	1.3%	2.4%
Czech Rep.	3.7%	3.8%	Estonia	1.3%	2.4%
Belgium	3.7%	3.8%	Cyprus	1.3%	1.6%
Hungary	3.7%	3.8%	Luxemburg	1.3%	1.6%
Portugal	3.7%	3.8%	Malta	0.9%	1.6%
Sweden	3.1%	3.1%			

Source: Authors´calculations.

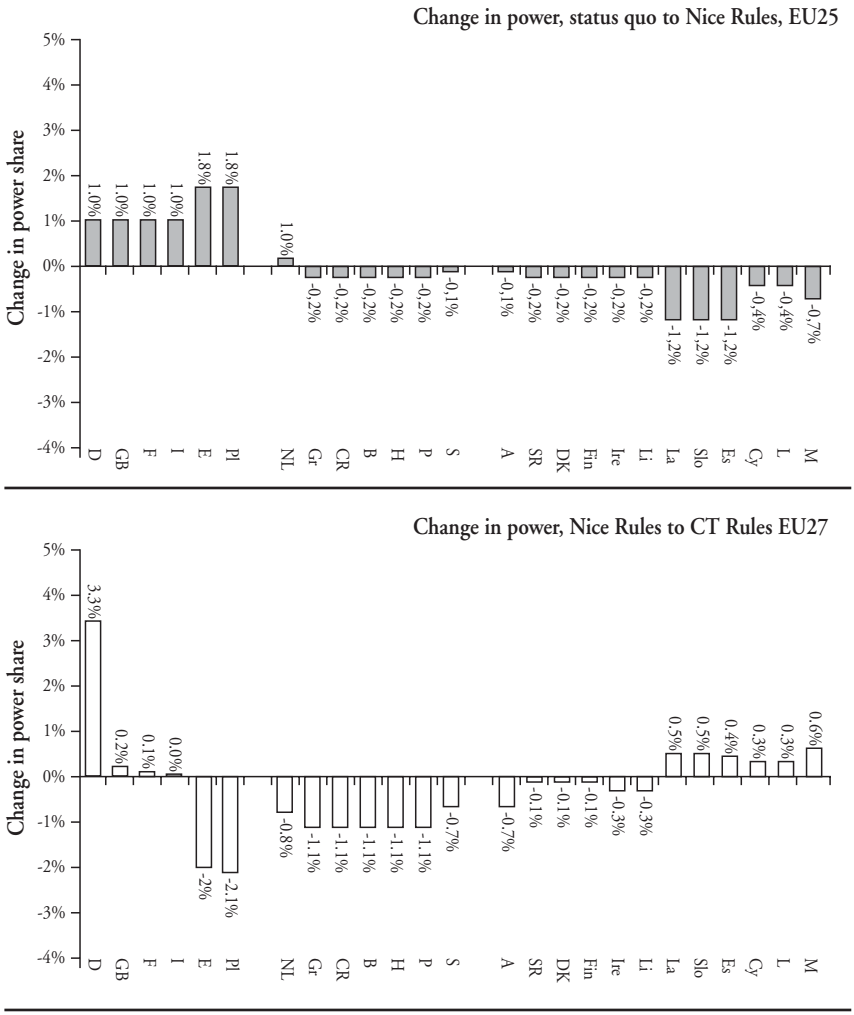
be more than offset by the "Zapatero compromise" when the CT rules take effect. Of course, Zapatero is likely to be out of power by then, having enjoyed 5 years of the "Aznar bonus" for. There are also important losses for the Mediums. Somewhat unexpectedly, the tiny members also gain from the Irish proposal – again compared to the Nice Treaty rules.

Finally, we turn the full analysis --power changes between today´s power distribution and the distribution that will be in effect when the Constitutional Treaty rules come into effect.

The Figure 4 shows the full shift that will occur between the voting rules in force today and the CT rules that come into effect in 2009. The salient features of the calculations are:

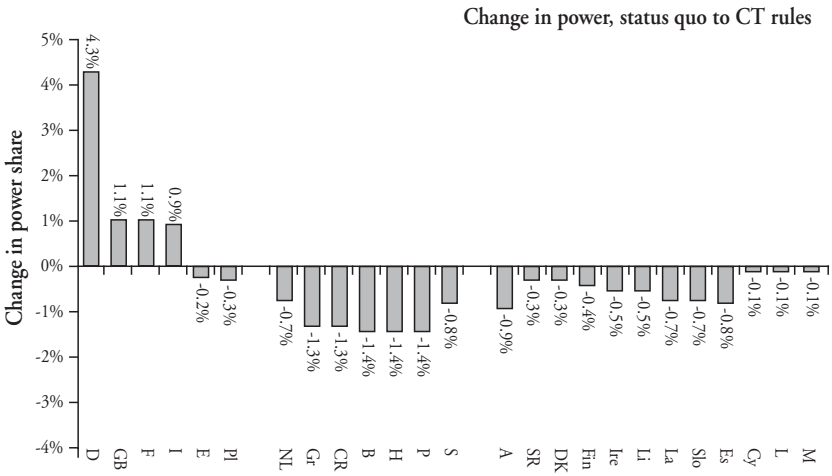
- The Big-4 and especially Germany are the big winners from the piecemeal voting reform that has been going on since the IGC2000.
- The biggest overall losers are not Spain and Poland since the "Zapatero compromise" merely undoes the "Aznar bonus". Of course, the Spanish and Polish Premiers who agreed to this are likely to be out of power by then, having enjoye 5 years the "Aznar bonus".

Figure 3.
Winners and losers by members: Nice rules and CT rules



- The Near-Big status that Spain and Poland won at Nice will be reversed; France will have about 40% more power than Spain.
- The biggest losers are the Mediums – nations with populations in the neighbourhood of 10 million.
- Franco-German power equality is ruptured; Germany will have about a third more power than France. The duo that drove European integration in the past will become an unequal partnership with France as the junior partner. Of course, French President Chirac who agreed to this is likely to be out of power

Figure 4:
Winners and losers by member, the full effect, status quo to CT rules



Note: Change in percentage points.

by then having finished out his term with Franco-German equality.

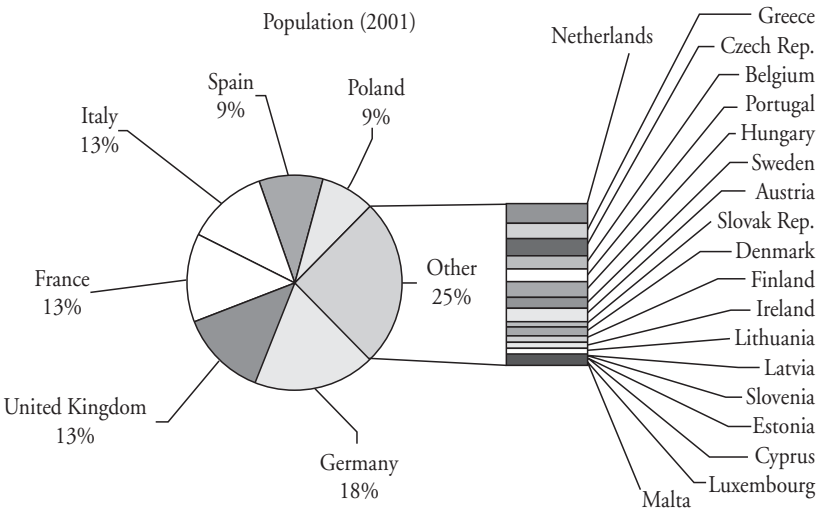
To summarise, the Constitutional Treaties will break the traditional French German power equality, making France the junior partner in the Franco-German alliance. Spain and Poland will lose the Near-Big status they won in the Nice Treaty. The biggest losers are the Mediums (about 10 million citizens).The Big-4 will have about two-fifths of all the power in the EU27.

3.5. Intuition for power shifts under double majority rules

The best way to think of a dual majority system is to view each member's vote as having two weights – one reflecting its population share and one reflecting its membership share. Given the radically skewed distribution of population shares in the EU (see Figure 5), the weights will be extremely different for different nations. For Germany, its population weight is huge, about 18% while its member-share is only 1/27. Plainly, Germany's member-share weight will be relatively unimportant to Germany's power. The opposite is true for small members like Estonia. Its population share is just 3-tenths

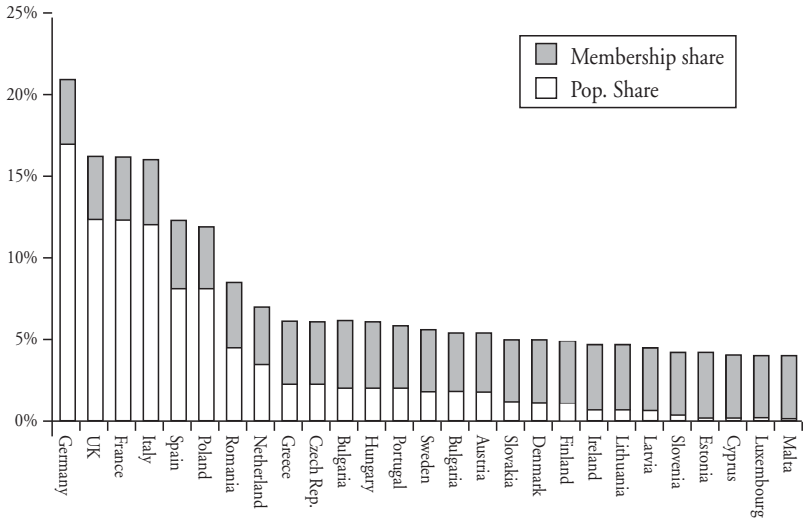
of one percent, but its membership share is 1/27, or 3.7%, so for Estonia, the member-share weight is the most important determinant of its power. (See Figure 6 for the full list.) Plainly then, changing the majority thresholds on population and membership will have different effects on large and small members. Specifically, raising the population majority rule raises the relative power of very big nations, while raising the membership threshold boosts the power of very small nations.

Figure 5:
The EU´s extremely skewed population distribution among members



Take an extreme example. If the population majority threshold was 83% and the membership threshold was 50%, Germany alone would be able to break any coalition, or, to put it differently, Germany would have a veto on everything. This veto-power comes uniquely from its population share; it would be true even if its membership share were zero. Now, think about the impact of lowering the population threshold from this extreme level to, say, 70% without changing the membership threshold. Such a change would clearly reduce Germany's power share a great deal, but it would have very little impact on Luxembourg's. After all, Luxembourg's population share (9-hundredths of one percent in the EU27) would almost never matter, whether the threshold was 83% or 70%. (However, power shares must add to 100% so a gain to Germany must imply a loss to others.)

Figure 6:
Relative importance of population and membership weights, EU27



Next, do the same thought experiment but start at the other extreme. Suppose the population threshold were 50% but the membership threshold were 97%. With such a threshold, any member could break any winning coalition, so they would all be equally powerful. Lowering the 97% to, say, 70% would reduce the significance of every nation's membership-share weight. However, exactly because the membership-share weights are much more important to small nations, lowering the membership threshold lowers small members' power relative to that of large nations.

3.6. Power of the newcomers and poor nations

Another cruder but more transparent approach to power involves looking at the blocking power of various coalitions that are identified ex ante as being highly likely to emerge, perhaps due to similarity of interests. The two coalitions we consider are an alliance of Easterners and an alliance of poor nations. How much blocking power would these two coalitions have under the Treaty of Nice rules and the CT rules?

Under the Nice Treaty rules that will govern EU decision making up for the whole life of the current European Commission and

European Parliament, Figure 1 shows that a coalition of poor nations would easily be able to block any decision in the Council. On the number of members criterion, they will have 2 more than the 14 needed to block, and on the votes criterion they will have 80% more votes than they would need to block any proposal. On the population criterion, not even the poor-coalition could block, but this does not matter; a measure can be blocked on any of the 3 thresholds. Once again we conclude that legislating under the Nice rules will be very difficult.

When the CT rules come into effect, the newcomers' power to block will be reduced. If they vote as a block, they'd need one of the EU15 members to side with them in order to block. One natural coalition would be the current poor 4, who roughly speaking would prefer that more were spend on poor regions than on farms, plus the newcomers. This groups of 14 would have 3 more votes than would be needed to block everything.

4. Ability to act

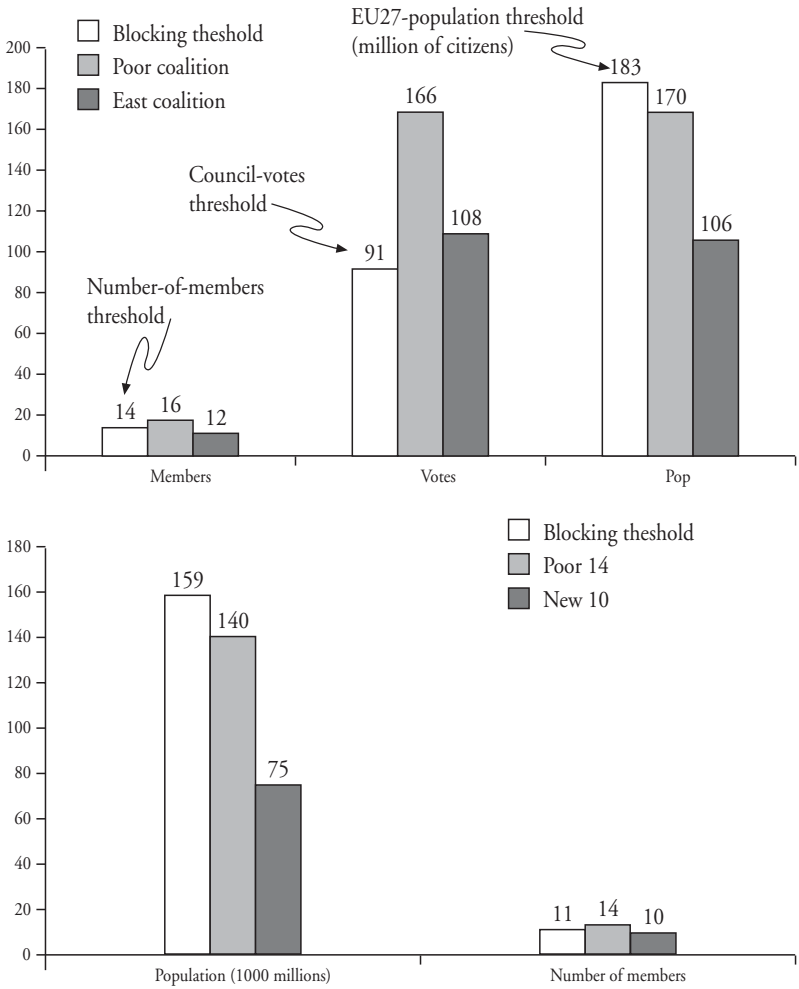
The major flaw in the Nice Treaty voting rules is the inability to maintain the enlarged EU's ability to take decisions. Since these rules will in any event be in operation at least until November 2009 – and potentially much longer if the CT is rejected – it is important to enumerate the EU's ability to act under the Nice Treaty rules. One useful measure to this end is called the passage probability.

4.1. The passage probability

"Capacity to act" and "decision-making efficiency" are slippery concepts, but one quantitative tool in voting game theory helps make things more precise. The so-called "passage probability" gauges how likely it is that the Council would approve a randomly selected issue – random in the sense that each EU member would be equally likely to vote for or against it. The best way to describe this measure is to explain how it is calculated.

First, the computer calculates all possible coalitions among EU members, namely every possible combination of 'yes' and 'no' votes by EU members (there are 134 million coalitions in the EU27). Then

Figure 1:
Bloking power of east and poor coalitions in the EU27, Nice rules



Notes: The leftmost bar in each group shows the number necessary to block a decision for the number of members, number of votes and share of population criteria, respectively. The middle bar in each group.

the computer checks each coalition to see if it is a winner under the Nice voting system; this is done using each member's actual weight on the three criteria (votes, members, population) and the three thresholds. The passage probability tells us what fraction of these coalitions are winning coalitions. It is called the passage probability because it is the likelihood that a random proposal would attract a winning coalition, assuming all coalitions are equally likely. Admittedly, this is a crude measure, but it is objective, precise and its strengths and shortcomings are clear.

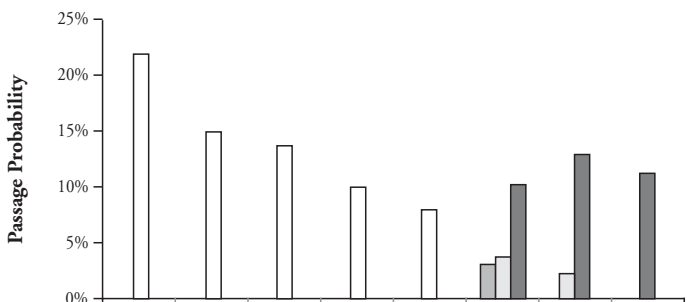
4.2. The passage probability under Nice and CT rules

It has long been know that the Nice Treaty rules cripple the EU's ability to act since they make it very difficult to find winning majorities (see calculations by Mika Widgren in Baldwin et al 2001). Figure 2 shows this clear. To provide some historical perspective, the five leftmost bars in the figure show the passage probability for qualified majority voting in historical EUs. Efficiency has been declining but past enlargements only moderately hindered decision-making efficiency. The last enlargement lowered the probability from 10% to 8%, and the Iberian expansion lowered it from 14% to 10%. The figures also hide the fact that the Single European Act, which took effect in 1987, greatly boosted efficiency by implementing

majority voting for Single Market issues. Looking forward, the figure shows that the EU is in for a big drop in its ability to act in normal Council matters, i.e. matters where qualified majority voting is in effect. We calculate that it will be between twice as hard to find a qualified majority as it was in the EU15. The southeastern enlargement foreseen in 2007 will make matters worse, although the Nice Treaty rules (as per the Accession Treaty) are slightly more efficient than the current rules.

By contrast, when the Constitutional Treaty's rules come into force, the EU's ability to act will soar. According to these calculations,

Figure 2:
Enlarged EU´s ability to act



	EU6	EU9	EU10	EU12	EU15	EU25	EU27	EU28
Historical	21.9%	14.7%	13.7%	9.8%	7.8%			
Status quo: May 04 to Nov 04						2.8%		
Nice rules: Nov 04 to Nov 09						3.6%	2.1%	
CT rules: Nov 09 onwards						10.1%	12.9%	11.2%

Notes: The figures show the "passage probability" which measures the likelihood that a randomly selected issue.

the CT rules will make it easier to pass a proposal in the EU27 than it was in the EU12. The entrance of Turkey would do little to change this assessment.

For comparison, we show how efficient the CT rules would be if they were applied immediately instead of in 2009. As the third set of bars from the right show, the CT rules would make it dramatically easier to get things through the Council of Ministers.

To summarise, the Nice Treaty voting rules defined in the Accession Treaty that will apply until the end of 2009 will lower EU decision-making effectiveness to unprecedented levels in the EU25 and EU27. Finding a qualified majority in the enlarged EU will be about twice as hard as it was in the EU15. The switch to the CT rules in 2009 will involve a quantum jump up in decision-making efficiency. It will be less difficult to find a qualified majority in the EU27 than it was in the EU12.

5. CONCLUDING REMARKS

This paper argues that the June 2004 EU Summit did not solve the enlarged EU's decisionmaking problems. Although the voting rules in the Constitutional Treaty rules will maintain the enlarged EU's ability to act, they will not take effect for 5 years. In the meantime, the botched Nice Treaty rules will govern Council decision-making – rules that are so flawed that EU leaders asked the European Convention to reform them even before they were implemented.

This failure will have important consequences because the next 5 years are so critical. They will determine how the enlarged EU functions and how it is perceived to function. This period includes the whole life of the next Commission and the next European Parliament. During these years, the EU will have to make many extremely difficult decisions. For example, the structural and farm spending programmes must be deeply reformed if the newcomers are to be treated as equals (the pre-set 2005 and 2006 budget allocations for the 10 newcomers imply distinctly less-than-equal treatment)[3]. Most importantly, these 5 years will be decisive when it comes to the public's opinion on the enlarged EU. If the next 5 years see a series

3. See December 2002, Danish Presidency Conclusions, Annex 1; on structural spending see European Commission, COM (2003) 34 final, Table 11.

of deadlock, bitter disputes and missed deadlines, EU citizens are likely to grow ever more disenchanted with the endeavour – and the Eurosceptics ever stronger.

Regardless of whether the Constitutional Treaty becomes law, the Nice Treaty rules will be in force during the critical, formative years of the new EU. In this sense, the most pressing task facing EU leaders is not to get the Constitutional Treaty past their voters, it is to fix the mistakes they did in Nice without a Treaty change.

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DISCUSSION

Isaac Towers asks about the possible consequences of the entrance of Turkey for the distribution of power and money within the EU governance mechanisms.

Antonio Ciccone wonders is the actual voting system (Nice treaty) is really so bad. In fact the Nice treaty set a higher threshold for acceptance of propositions from the Commission. If many (or some) of those propositions were not Pareto-improving setting stiffer requirements does not necessarily decreases welfare. In fact the higher threshold guarantees that most of the measures being approved would surely improve the overall welfare in the EU and not only in some countries. He suggests using the expected total gains of each measure as a benchmark for a given proposal desirability.

Richard Baldwin thanks the comments. He remarks that the voting system (based in country population) in the EU is appropriate as long as the distribution of population across the country members is not very skewed, and this was the case in EU15. However after the enlargement the situation has changed dramatically (the case of Malta is an example). In this situation and if the Nice treaty does not change, the consequence would be that only the non-controversial (politically easy) proposals would be approved. The economic reforms are not included in that category. He thinks the Constitutional treaty will be rejected. But this is not necessarily a bad thing because probably there is the need of shock to politicians to force them to address a change in the Nice treaty in a more appropriate frame of mind.